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**Version 3.0**

# **Aphelion User Guide**

**Amerinex Applied Imaging, Inc.**

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# Aphelion User Guide

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## Product Overview

### **Image Processing and Image Understanding**

Aphelion™ is a development environment and delivery vehicle for image-based applications. It is the only software product for Windows 95/98 and Windows NT that provides the latest developments in mathematical morphology and symbolic representation, as well as the most effective tools for quantitative image analysis, pattern recognition, and classification.

Jointly developed by Amerinex Applied Imaging, Inc. and ADCIS SA (France), Aphelion combines and enhances the best technology available to the two companies, including key elements of AAI's KBVision™ System, the X-LIM morphology software from the Paris School of Mines, and both companies' expertise in Windows.

Aphelion contains:

- Core Module
- Visualization Module with professional quality display tools
- Developer Module for application development
- BasicScript Language for macro development
- Online Help
- Multiple Language Documentation
- VisionTutor™ Computer Vision Course

The main window of the interface can simultaneously display multiple documents such as images, graphics, text, spreadsheets, and objects.

## **Copyright and Trademark Information**

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KBVision and VisionTutor are trademarks of Amerinex Applied Imaging, Inc.

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## Core Module

The Aphelion™ Core Module provides the following capability:

- Image Processing Operators
- Image Understanding Operators
- Morphological Operators
- Image Analysis Operators
- Support for Importing and Exporting Images
- Support for I/O Hardware
- Support for Processing Accelerators
- Database for Symbolic Features/Attributes

## Visualization Module

The Aphelion™ Visualization Module includes the visualization of 2D and color images. It is part of the Developer module, and is available as a set of ActiveX components or as a subset of Aphelion. For more information about the Visualization Module, see the *Aphelion Developer Guide*.

## Developer Module

The Aphelion™ Developer Module contains:

- Core and Visualization Modules
- Graphical User Interface (GUI)
- Menu-Based or Script-Based Selection of Operators
- Drag-and-Drop of Images, Symbolic Data, Objects
- BasicScript Language
- Project-Based Interface to Control Workspaces and Data
- Online Documentation and Multiple Language Support

## Online Help

The Aphelion online Help system includes the following guides:

- *Aphelion User Guide*
- *Aphelion Reference Guide*
- *Aphelion Developer Guide*
- *Macro Language Reference Guide*
- *Macro Dialog Editor Guide*

The online Help also includes context-sensitive Help for menu commands, toolbar buttons, and other interface elements.

### Aphelion User Guide

The *User Guide* contains information about the Aphelion interface, including:

- descriptions of all toolbars and buttons
- procedures for accomplishing standard tasks such as loading an image and recording a macro

### Aphelion Reference Guide

The *Aphelion Reference Guide* contains information about specific operators, including parameters and default values, and about macro functions and other routines.

### Aphelion Developer Guide

The *Aphelion Developer Guide* provides information about using Aphelion-Developer. This guide includes examples for using Aphelion operator DLLs from a custom C/C++ program and for extending the Aphelion operator library.

## Accessing Online Help

You can access online Help at anytime while you are using Aphelion.

- To access the entire Help system, choose **Help→Aphelion Help Topics** from the menu bar. You can use the Index tab to search for a particular topic, or click the Contents tab to choose the topic you want.
-  To view help for a specific interface element such as a menu command or button, click the Context Help button, then point and click on the element.

- To access help for a specific dialog box, press **F1** while in the dialog box or click the **Help** button for the dialog box.

### Quick Help

Quick Help provides brief descriptions of Aphelion interface elements and operators. Quick Help is displayed at the left end of the Statusbar at the bottom of the Aphelion screen.

Use this operator to threshold the input image between a lower and upper bound. [ 34, 160 ] = 177

- To view Quick Help for an interface element such as a toolbar button, move the cursor over the button.
-  To view Quick Help for an operator, click the Select Operator button in the Operator dialog box, and move the cursor until it is positioned over the name of an operator.

## Other Documentation

In addition to the online Help, the following documentation is available:

- **Installation Guide and Quick Overview.** This guide is distributed with your CD. Much of the material is also available in the Getting Started section of the online *Aphelion User Guide*.
- **Demo Movies.** The Aphelion CD contains a set of multimedia demos and tutorials in the Demos sub-directory. These ScreenCam movies provide an introduction to Aphelion interfaces, concepts, and algorithms. To play a file directly from the CD, drag the .scm file onto the scplayer program. Or, for more convenience, copy the Demos sub-directory to the Aphelion installation directory. You can then click the ShowDemos button on the main toolbar in Aphelion, and select a demo.

Note that the movies include sound, so you should enable the speaker on your PC.

- **Release notes.** The release notes detail features of each new Aphelion release, including new operators, fixes to known problems, and documentation updates. You can read the release notes file, README.txt, during the installation process. If you want to read the file after you have installed Aphelion, you can access the file in the directory where you installed Aphelion, typically C:\Program Files\Aphelion
- **FAQ.** The FAQ (Frequently Asked Questions) list is available at the Amerinex Web site:

<http://www.aai.com/AAI/APHELION/FAQ.html>

## Multiple Language Documentation

The Aphelion user interface supports the English, French, and Kanji languages. Menus, messages, tooltips, and Operator text are translated and displayed.

To select a language, choose the **View** menu, then click **Language**. Select one of the following languages:

- English
- French
- Kanji

## VisionTutor



VisionTutor™ is a computer vision course that provides an introduction to image processing and image understanding. VisionTutor is an optional module for Aphelion™ users.

VisionTutor allows the user to explore the concepts of computer vision, image processing, and image understanding. The VisionTutor experiments consist of Aphelion macros that perform experiments automatically and allow the user to investigate the results. The experiments enable the user to explore the nature of computer vision algorithms by providing interaction with the operators and images.

### Course Syllabus

- Introduction
- Image Formation
- Image Enhancement
- Edge Detection
- Morphology
- Region Segmentation
- Convolution, Filtering, and Fourier Transform

To order VisionTutor, please contact your Aphelion distributor or your local representative.

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## Getting Started

The Getting Started section provides you with basic information about using Aphelion, from starting the application to processing images and printing your results.

## Finding Your Way Around

### Windows

To use Aphelion, you should be familiar with Windows 95/98 or Windows NT 4.0, and basic Windows features such as clicking, double-clicking, and drag-and-drop editing. If you have not used Windows 95/98 or NT before, we recommend that you attend a training session or refer to books such as *Introducing Microsoft Windows 95* or *Windows NT 4.0 Workstation Step by Step* for more information.

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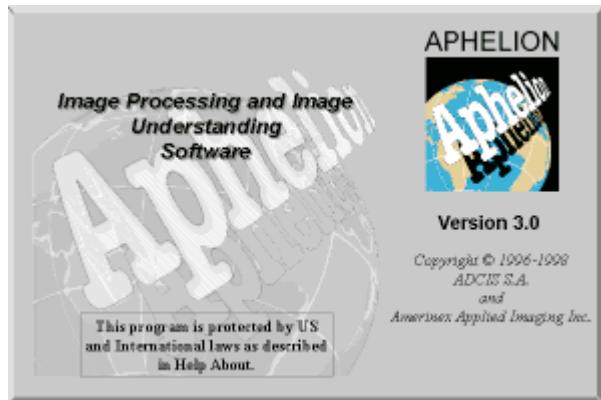
**Tip** The pop-up menu, a Windows 95/98/NT feature, is used extensively throughout Aphelion. In many windows and areas of the Aphelion interface, you can click the right mouse button to display a pop-up menu of commands related to the particular window or area. For example, click the right mouse button in an Image window to display the Image pop-up menu.

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## Starting and Exiting Aphelion

After installing Aphelion, start the application by clicking the Aphelion icon on the **Start:Programs** menu of Windows 95/98 or Windows NT.

- The Aphelion "splash screen" appears, displaying copyright information and the Aphelion release number.



- The splash screen disappears after a few seconds and the graphical user interface opens, covering most of the area of the monitor. The "Tip of the Day" window opens automatically. If you do not want to see the Tip of the Day each time you start Aphelion, clear the **Show Tips on Startup** check box in the Tip of the Day window.

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**Note:** To exit Aphelion, choose **File→Exit** from the menu bar or press **Alt+F4**. A message box appears, asking if you want to save the current project file. Click **Yes** to save the project file or **No** to exit without saving changes to the project file. Click **Cancel** to return to Aphelion without saving the current project.

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## Terminology

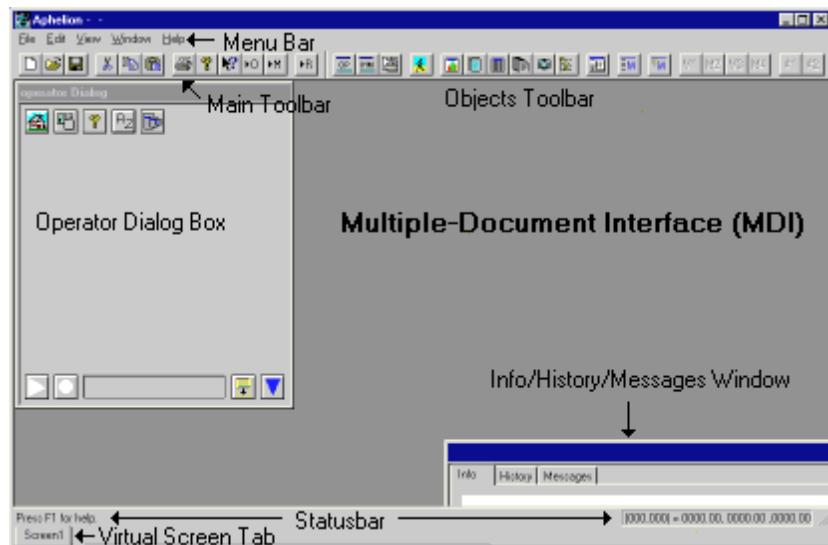
To use Aphelion, you should be familiar with the following terms:

- **BasicScript** - A scripting language compatible with Visual Basic. In Aphelion, you use BasicScript to create macros.
- **Chart** - A histogram, profile, surface map, or scatter plot window. You can modify the properties of a chart using the Properties command on the Chart pop-up menu.
- **Display Context** - A function converting pixel values into lookup table (LUT) indices. For example, a display context allows you to display an image of unsigned 16-bit values between 0 and 65536 on an 8-bit display. The conversion functions include linear, absolute value, logarithmic, and periodic.
- **Grid** - Object measurements displayed in a spreadsheet format. For example, a Grid document may be used to display ObjectSet data for analysis and charting.
- **Measurement** - Any attribute computed for an image or an individual object. Typically, one column in an ObjectSet.
- **Message passing** - A mechanism that sends messages between image views containing object overlays and a grid or chart document, allowing you to view the same information in different formats. You can also use message passing between two image windows.
- **Object** - A region, point, rectangle, line, edgel, or chain, and its associated measurements. One row in a grid (spreadsheet) represents an object.
- **ObjectSet** - A set of Objects from the same original data using the same algorithm. A data structure that stores both the spatial description and attributes of an event. Typically, a method of feature extraction is initially executed using a pixel data Image (low data level) to extract the Objects where different algorithms are used to produce different sets of Objects.

- **Operator** - An image processing or image understanding algorithm, implemented as a separate routine. Each routine is called an operator and is available through the interface or as a DLL.
- **Project** - A file that stores images, image settings, and other information such as virtual screen names. You can use an Aphelion project file to save information and settings specific to a particular task. Project files have the extension .ap.
- **Virtual screen** - Multiple displays that occupy the same screen space. Each display can contain various documents, such as images, grids, and text. To display a virtual screen, click its associated tab at the bottom of the Aphelion interface.
- **Virtual screen filer** - A dialog box that shows each virtual screen and all elements, such as images and grids, associated with that virtual screen. You can use drag-and-drop editing to move elements from one virtual screen to another.

## **Graphical User Interface**

The Aphelion interface contains a menu bar, toolbars, Statusbar, Operator dialog box, Info/History/Messages window, and an area called the workspace, where images, macros, graphics, text, and all other Aphelion documents are displayed and processed.



### **Menu Bar**

The menu bar, located near the top of the screen, contains menus such as File and View that list commands for Aphelion activities.

### **Main Toolbar**

The Main toolbar, which appears just under the menu bar, contains buttons for common Windows tasks such as open, save, and print.

### **Objects Toolbar**

The Objects toolbar, located to the right of the Main toolbar, contains buttons for working with objects in Aphelion.

### **Other Toolbars**

Other toolbars, such as the Image toolbar, are displayed depending on what window is active.

### **Statusbar**

*Quick Help provides brief descriptions of Aphelion interface elements and operators. Quick Help is displayed at the left end of the Statusbar at the bottom of the Aphelion screen.*

The left end of the Statusbar displays Aphelion Quick Help. The right end displays the current pixel coordinates and value.

### **Operator Dialog Box**

The Operator dialog box is used to choose algorithms to apply to your images, supply parameters, and execute the code.

### **Info/History/Messages Window**

The IHM window contains three tabs that provide convenient access to extensive information about the current environment.

### **Virtual Screens**

Aphelion supports virtual screens. That is, multiple displays can occupy the same screen space. You choose between virtual screens using the virtual screen tabs at the bottom of the screen. When you first start Aphelion, there is only one virtual screen and virtual screen tab, labeled Screen 1. You can create additional virtual screens.

## **Using Help**

You can access online Help at anytime while you are using Aphelion.

- The *Aphelion User Guide* provides reference and procedural information for using Aphelion.
- The *Aphelion Reference Guide* provides comprehensive information for each Aphelion operator.
- The *Aphelion Developer Guide* provides information about using Aphelion-Developer. This guide includes examples for using Aphelion operator DLLs from a custom C/C++ program and for extending the Aphelion operator library.

For advanced users, the *Macro Language Reference Guide* and *Macro Dialog Editor Guide* are also available online.

---

**Tip** To print selected portions of the Help files, use the Contents tab in the Help Topics window. On the Contents tab, select the "book" you want to print and then click the **Print...** button. All Help topics contained under that heading will be printed.

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### **Accessing Online Help**



To access the entire Help system from the Contents page, click the Help button on the Main toolbar. You can use the Contents page to find the topic you want, or click the Index tab and search by a word or letters for a particular topic.



To access the entire Help system from the Index page, choose **Help→Aphelion Help Topics**. You can use the Index page to search by a word or letters for a particular topic.



Within the Operator dialog box, click the blue Help button to display documentation about the currently selected operator.

**F1**

Within the Operator dialog box, press **F1** to access Help topics for the Operator dialog box, including how to select and run an operator.



To view help for a specific interface item such as a menu command or toolbar button, click the Context Help button, then point and click on the item.



To access help for a specific dialog box, click the **Help** button in the dialog box or press **F1**.

**Tip**

If you frequently reference a specific topic in online Help, you can place a Bookmark on that topic. First, display the topic you want to bookmark. Then choose **Bookmark→Define** from the menu bar of the Help screen. Click **OK** to add the currently displayed Help topic to the Bookmark list. The next time you access online Help, click the Bookmark menu and select the bookmarked topic from the list.

For more information about how to use Help, see Online Help.

## Quick Tutorial

If you are a new user and want to try out some of the basic tasks in Aphelion, you can follow the Quick Tutorial outlined below. The tutorial demonstrates how to open an image, select and run an operator, and execute a macro. The steps in bold represent the general task, while the specific actions you should follow are listed in the paragraph following the bold step.

We recommend that you read the complete Getting Started section before using Aphelion on a regular basis, and look up information as needed in the *Aphelion User Guide* and the *Aphelion Reference Guide*.



**1. Open an image.**

On the Main toolbar, click the Open icon. From the Open dialog box, double-click on the file **Ceramic.tif**. The image opens in an image window.



**2. View or change the display parameters for the image as needed.**

With the cursor positioned anywhere in the image window, click the right mouse button to display the Image pop-up menu. Choose **Properties** to change display parameters such as the lookup table and the display context.



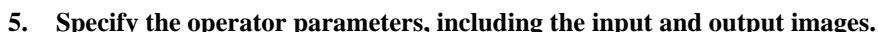
**3. Select the operator you want to run.**

In the Operator dialog box, click the SelectOperator button. From the drop down list, click **Filtering→Low Pass→ImgLowPass3x3**. The Operator dialog box displays the input and output icons for ImgLowPass3x3.



**4. View the online Help for the selected operator.**

In the Operator dialog box, click the OperatorHelp button. The Help topic for the currently selected operator, ImgLowPass3x3, is displayed. To close the Help window, click the close button in the upper right corner of the Help screen.



**5. Specify the operator parameters, including the input and output images.**

In the Operator dialog box, click the input image icon and select the image you want from the drop-down list (in this case, there is probably only one image listed, Ceramic.tif). For the output image, use the default New image which is already selected. There are no other parameters for ImgLowPass3x3.



**6. Run the operator.**

On the toolbar at the bottom of the Operator dialog box, click the Run Operator button. While the operator is running, the stop sign button turns red. You can stop

the operator by clicking on the red stop sign button. When the stop sign button turns white, the operator has completed running. View the results (in Image 0).

7.  **Select a macro from the list of macros distributed with Aphelion.**

On the Objects toolbar, click the **Macros** button. Choose **Macros**, then select **Ceramic.apm** to open a macro window containing Ceramic.apm.

8.  **Run the macro.**

On the Macro toolbar, click the Run button. As the macro runs, Aphelion displays dialog boxes that allow you to select certain features.

9.  **View the results in an Aphelion grid document.**

On the Objects toolbar, click the **ObjectSet List** button. Select a grid from the drop-down list.

10.  **Free all open images.**

In the Operator dialog box, click the **ImgFreeAll** button. Aphelion displays a message box asking you to confirm that you want to free all open images. Click **Yes** to free all open images.

## Loading and Saving Images

There are three methods for loading images into Aphelion:

- Load one of the supported file formats (TIFF, BMP, JPEG, KBV)
- Import an unsupported format
- Capture a live image

### Opening and Saving Images

Aphelion supports the following image file formats:

- Tagged image file (.tif)
- Bitmap (.bmp)
- JPEG (.jpg)
- KBVision (.im)



#### To open an image

1. From the **File** menu, choose **Open Image**. The Open dialog box appears, listing all .tif images available in the Aphelion\Images directory. To change the type of file listed, click the drop-down arrow in the Files of type field.
2. Double-click the image you want to load. The image opens in an image window. The Image toolbar is displayed along the right side of the screen.

---

**Shortcut:** To open an image, click  on the Main toolbar or press **CTRL+O**.

---



#### To save an Image

After you make any changes to an image, you must save the image or the changes will be lost when you exit Aphelion.

1. Make sure the image window you want to save is active. To make an image window active, click on its title bar.
2. From the **File** menu, choose **Save As Image**. The Save As dialog box opens, listing all .tif images available in the Aphelion\Images directory. You can change the directory as needed.
3. From the list of images, choose the one you want to save. (Or type the name of the file in the File name field.)
4. Click the **Save** button. Aphelion displays a message box asking if you want to replace the existing file of the same name. Click **Yes** to write over the existing file or **No** to cancel.

---

**Shortcut:** To save an image, make sure the Image window is active and click  on the Main toolbar or press **CTRL+S**.

---

### ***Other Image Formats***

If you have images in a format other than the supported formats (TIFF, BMP, JPG, and KBV), you can import the images into Aphelion using the AphImgImport operator or a third-party conversion application.

AphImgImport allows you to read an uncompressed binary file into an Aphelion image. For example, a SUN raster file can easily be imported into Aphelion using AphImgImport.

#### **To use the AphImgImport operator**

1. Determine the image size, pixel type, and file characteristics of the image you want to import.
2.  In the Operator dialog box, click the **Select Operator** button.
3. Click **ImageUtilities→Input/Output→AphImgImport**.

**Note:** You must define the size and type of the output image. In the Operator dialog box, click the Output image icon, then choose **New w/ Options**.

#### **To use a conversion program**

Several image conversion applications are widely available. To convert a file, first load the image, and then save it as a TIFF or BMP image.

<b>Image Conversion Application</b>	<b>Company</b>
Graphics Workshop	Alchemy Mindworks, Inc.
HiJaak	Quarterdeck Corp.
Image Alchemy	Handmade Software, Inc.
LView Pro	Leonardo H. Loureiro
PaintShopPro	JASC, Inc.

### ***Acquiring Images***

Aphelion has built-in support for several digitizer boards. If you have one of the boards listed below, you can capture live video at full-motion rate:

- Imaging Technology, Inc. (ITI) - IC-PCI module (AM-VS, AM-DIG, AM-FA, AM-CLR, STD-COMP, STD-RGB)

- MuTech, Inc. - MV-1000 (monochrome), MV-1300 (color), IV-450
- Data Translation, Inc. - DT 3155 (monochrome)
- Matrox Meteor, Matrox Meteor II, Matrox Meteor/RGB, Matrox Meteor/PPB
- Matrox Pulsar and Corona for non-standard acquisition
- Integral Technologies - FlashPoint 128 (monochrome and color)

---

**Note:** Aphelion also supports Twain drivers.

---

Additional hardware support is planned for future Aphelion releases.

#### To acquire a live image

1. On the Objects toolbar, click the **Camera** button.
2. Select the logical camera you want to use.
3. In the Operator dialog box, click the **Select Operator** button.
4. Choose **Image Acquisition→Grab/Snap→ImgSnap**.
5. In the Operator dialog box, click the **Acq board** drop-down list to select the acquisition board you want to use.
6. Run the operator. The image appears in an image window.

---

**Tip** If the Operator dialog box is not visible, click on the Objects toolbar.

---

## Viewing Images

When you load an image, it is displayed in an image window. The following sections describe how to investigate image properties through different views of the information in the image.

#### Image View

The image view can be varied in many ways. This includes zooming, panning, and changing the display mapping by altering the brightness and contrast or the display LUT.

- Zooming and panning
- Changing the display context
- Changing brightness and contrast
- Changing the LUT
- Resizing an image

---

**Tip** You can modify several image characteristics from the Image Properties dialog box. Click the right mouse button in an image window to display the Image pop-up menu. Choose **Properties→Properties**. You can get precise information about an image, as well as adjust its characteristics or presentation properties. For example, you can change the underlying data type for operators that require input images to be of a specific data type, or change the lookup table to view fine detail in images that are too dark or too bright.

---

## Histogram

The histogram view shows the gray level histogram for an image. A histogram is useful for determining which processing and segmentation techniques will be effective. For example, if the histogram is bi-modal, many of the automatic threshold techniques, such as AphImgEntropyThreshold or AphImgMaximumContrastThreshold, work well. The histogram can also indicate digitization problems that may need to be corrected through filtering. For example, if every odd location in the histogram is zero this may be due to an image with less than 8 bits per pixel being scaled up to fill 8 bits.

## Profile

The profile view shows the intensity surface of an image along one line. This is useful for examining the sharpness of edges and the signal-to-noise ratio.

## Running an Operator

To run an operator, the Operator dialog box must be open in the interface. You then select the operator you want to run, supply all parameters, including input and output images, and run the operator.

---

**Tip** If the Operator dialog box is not visible, click  on the Objects toolbar.

---

### Selecting an operator

Operators are selected using a multi-level drop-down list. The first list gives the operator groups, the next level breaks each group into subgroups, and the final level lists individual operators.

 You can also select an operator from an alphabetical list of all operators by clicking the **A...Z** button. For more information, see Selecting an Operator.

### To select an operator

1.  Click the **Select Operator** button.
2. Move the pointer to the right to display groups, subgroups, and then operators.
3. Highlight the operator you want and click the left mouse button.

---

**Note:** After you select an operator, Aphelion displays check marks next to the selected group, subgroup, and operator name.

---

### Parameters

You must set the value for each parameter before running an operator. Parameters include:

- Names of the input and output images
- The name of the kernel for a convolution
- The size of the kernel
- The shape of the structuring element for morphological transformations

Most parameters are set by selecting a value from a drop-down list. Some parameters, such as strings and numbers, must be typed. For more information, see Selecting Operator Parameters.

---

**Tip** Before you run an operator, you must first specify all parameters including any input and output images.

---

### Advanced Parameters

For some operators, advanced parameters are available. Advanced parameters allow greater control over processes such as segmentation. If an operator includes advanced parameters, the advanced parameter button is available.



Click to display the advanced parameters and supply values.

### To run an operator

To run an operator, use the toolbar buttons at the bottom of the Operator dialog box.

Button	Function
	To run an operator, click the green arrow button.
	To cancel the operator while it is running, click the red stop sign button.
	When the operation is complete, the stop sign turns white.

---

**Shortcut** To run an operator, press **CTRL-R**.

---

After running an operator, the output image is displayed (if applicable). See Viewing Images for information on obtaining different views of the image.

## Processing Images

This section describes how to process and enhance images.

### Filtering to remove gray level noise

Gray level noise is characterized by varying pixel values. This noise can be random or regular.

- **Linear or Convolution Filters**

Linear filters are the most basic of image processing tools. Depending on the kernel passed to AphImgConvolve, you can apply a low-pass filter or a high-pass filter to an image. For removing random gray level noise, use one of the low-pass filters available in Aphelion, such as AphImgLowPass5x5.

- **Non-linear Filters**

Non-linear filters are filters whose output is not proportional to the input. For example, smoothing by averaging is linear, while median smoothing is not. An example of a non-linear filter in Aphelion is AphImgMedian. This operator replaces the central pixel with the median, or middle, value when all the neighborhood values are ordered from lowest to highest. As with the linear low-pass filters, a larger neighborhood results in a more uniform output image.

- **Frequency Filters**

Frequency filters are useful when you have predictable gray scale noise. It is often useful to run AphImgFFT to view the power spectrum of the image. If you see well-

---

<sup>K</sup> filtering

defined clusters which are not near the center of the power spectrum these may be noise that can easily be removed using one of the frequency filtering operators such as AphImgLPRectangularFilter.

- After filtering the power spectrum image, use the AphImgInverseFFT operator to recreate the gray scale image.

### Filtering to remove spatial noise

Some noise is spatial rather than gray level. This noise is characterized by rough boundaries, or holes in objects. The morphological operators can be very effective at cleaning up this kind of noise. For instance, AphImgOpen can be applied to a binary, gray scale, or color image in order to remove outlying fringes of bright objects. AphImgClose can be used to fill in holes in objects.

### Other image processing

The above sections are an introduction to just one section of the operator library in Aphelion. Here are other image processing sections, with example operators:

- Arithmetic/Logic (AphImgAdd, AphImgMultiplyConstant)
- Edge Detection (AphImgSobelEdges)
- Transforms (AphImgRotate, AphImgRGBToHSI)
- Acquisition (AphImgSnap)
- Utilities (AphImgCreateGaussianNoise, AphImgCopy)

## Extracting Objects from Images

This section describes how to use Aphelion to measure distances, sizes, and objects in images.

### Global Measurements

Global measurements are those computed directly on the image. For example:

- Given a binary image, you can compute the number of foreground pixels as the area of the image. This measurement is computed by AphImgArea.
- Given a gray scale image, you can compute the sum of all the pixel values as the volume of the image using AphImgVolume
- Other global measurements are interactive. For instance, AphImgDistance reports the length of a line you draw in the image overlay.

---

**Tip**

When you select a global analysis operator, such as AphImgVolume, the  button appears in the Operator dialog box. This button allows you to indicate if you want the output displayed in the Info window. For AphImgHistogram, AphImgBandHistogram, and AphImgProfile, you can also choose to display the output in a Profile or Histogram window or export the output to an Excel spreadsheet.

---

### Calibration

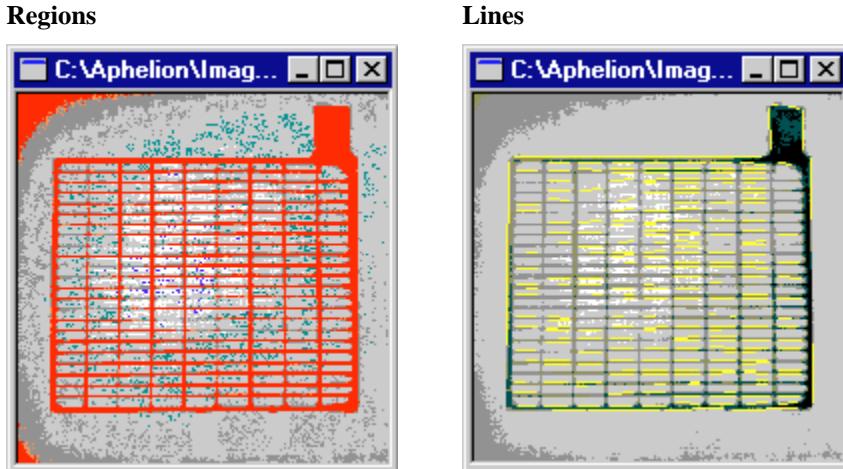
Many global measurements can be computed in physical units, rather than pixels. To do this, you first need to calibrate the image.

For more information, see Calibrating an Image.

## **Segmentation**

You may often be interested in individual objects in an image, rather than characteristics of the overall image. You can define these individual objects using segmentation operators.

The following figures show regions and lines extracted from the same image:



Regions are the most common object representation. A region is a set of connected pixels stored in a bitmap representation. The most basic way to get regions is to threshold the image using AphImgThresholdObj. This operator is manual, in that you have to specify the low and high bounds of the threshold. There are also a number of automatic segmentation operators, such as AphImgEntropyThresholdObj.

---

**Tip** All Aphelion region segmentation operators have two versions, one that ends in “Obj” and one that doesn’t. The “Obj” operator creates regions within the ISR, while the others create binary and label images.

---

Many other object representations are available in Aphelion. The following list gives example operators for each:

- Lines (AphImgGradientLines)
- Edgels (AphEdgesToEdgels)
- Rectangles (AphLabelsToRectangles)
- Chains (AphEdgelsToChains)
- Polygons (AphRegionConvexHullPolygons)

## **Object Measurements**

**Object** - A *region, point, rectangle, line, edgel, or chain, and its associated measurements. One row in an ObjectSet.*

Object measurements are attributes computed for objects such as regions, lines, and chains. Typically, measurements are computed in order to filter, classify, or quantify actual objects in the image. Aphelion contains powerful object measurement database, visualization, and calculation tools.

### **ObjectSets**

ObjectSets are represented in the Intermediate Symbolic Representation (ISR). The ISR is a database used to store and retrieve object measurements. The easiest way to conceptualize the ISR is to think of it as a two-dimensional array, just like a spreadsheet. In this analogy, the rows are objects, and each column represents one specific measurement. The ISR is much

more than a spreadsheet, though, because it allows for efficient addition and deletion of objects and measurements (rows and columns), and for spatial access.

There are a number of ISR utility operators, including:

- AphObjCopy
- AphObjFilter
- AphObjRead

### Tips

- To load and save ObjectSets (ISR databases), use the **Open ObjectSet** command on the **File** menu.
- The Aphelion ISR file format is completely compatible with the KBVision ISR file format.
- Using AphObjDraw, you can draw spatial attributes (regions) as an overlay on a gray level image.

### Example

This example describes how to start with an image and produce object measurements in a grid.

1. Run AphImgThresholdObj to produce region objects in the ISR. To do this, set the input image from the pulldown list by clicking within the "Input" box, type "regions" in the "Output ObjectSet" type-in box, and then slide the Low and High threshold sliders until the desired objects are colored red in the image.



Click the Run Operator button to execute the operator.

2. Run AphObjComputeMeasurements to compute all the available region measurements. To do this, select the input image from the pulldown list under "Input", and then select the region set from the pulldown list attached to the "Input ObjectSet" parameter.



Click the Run Operator button to execute the operator.

You now have regions in an ObjectSet, with measurements computed for each region.

3. On the Objects toolbar, click the Objectset List button to open the grid. Select **Regions**.
4. View the measurements as described in the Grid section.

### Grid

Results from an object analysis are automatically saved in an Aphelion grid, or spreadsheet. A Grid document can be used to display ObjectSet data for analysis and charting.

You can specify whether you want a grid to open automatically each time an ObjectSet is computed.

- To open grids automatically when they are computed, choose **Preferences** from the **Options** menu. Make sure that the **Automatically display grid** option is checked.
- If you do not set up grids to open automatically, you can open a grid using the following procedure.

### To view ISR data in a grid

1.  On the Objects toolbar, click the ObjectSet List button. The pop-up menu lists the grids that have been created. Each grid has the same name as the corresponding ObjectSet.
2. Select the grid you want to open.

The grid can be used to sort, filter, modify, and export measurement data. It can also be used to select an individual object or a set of objects to view in the overlay. For more information, see Grid Documents and Message Passing.

### Supported Measurements

Aphelion supports a wide range of measurements for objects through the AphObjComputeMeasurements operator. Given a set of regions, this operator allows you to compute all or some of the available region measurements. When presented with lines or another representation, the operator computes the appropriate measurements.

Summary of object measurements:

- Region location, area, shape, texture, color
- Line location, length, angle, contrast, color
- Chain location, length, curvature, contrast, color
- Polygon location, area, boundary length, color
- Edgel location, angle, magnitude, color
- Rectangle location, area, color

See the Help page for AphObjComputeMeasurements for more information about each measurement.

---

**Tip** Each object representation can be converted to a region using AphObjSpatialAttributeToRegions. This makes it possible to compute all the region measurements for objects such as lines, chains, and polygons.

---

### ***Other object processing operators***

The above sections are an introduction to the object operator library in Aphelion. Here are the other object processing sections, with example operators:

- Conversion (AphObjSpatialAttributeToRegions)
- Transforms (AphObjRotate)
- Morphology (AphRegionErode)
- Grouping (AphEdgelsToChains, AphRegionSplitConvex)
- Analysis (AphImgVolume, AphRegionFeret, AphChainAttributes)
- Utilities (AphObjFilter, AphObjCopy)

## Reporting Results

### Printing

In Aphelion, you can print individual documents such as images, macros, and charts. You can also use Print Page Design to compose a printed page with documents and text.



Focus on the window that contains the document, such as an image or macro, that you want to print.



Click the Print Page Design button on the Objects toolbar to open a Print Page window. Click the right mouse button to display the Print Page Design menu and add images, charts, and text to the page.

Use the mouse and the pop-up menu to move, resize, and position the elements on the page. Then click the Print button on the Main toolbar to print the page.

### Exporting Object Measurements

You can export object measurements to Excel, Access, or any other Windows program in order to sort, report, print, or graph results. Use the AphObjExport operator to create a TAB-separated ASCII file. This type of file can be imported into Excel, Access, and other programs using their Insert commands.

For more information, see Exporting Data from Aphelion.

## Scripting

BasicScript is a powerful Visual Basic compatible scripting language. Using BasicScript, you can record sequences of operators, loop over a number of images or objects, access pixels, and create dialogs.

---

**Note:** Macro files have the extension **.apm**.

---

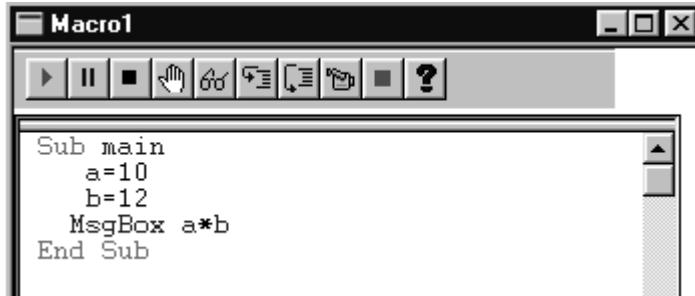
### Loading a macro

1. From the **File** menu, choose **New**. The New dialog box opens.
2. Choose **Macro Document** and click **OK** to open a macro window.
3. In the macro window, click the right mouse button to display a pop-up menu.
4. Choose **Load** to display the Open dialog box, listing the macros in the macro directory. Highlight the macro you want to load and click **Open**.

---

**Shortcut:** Click  on the Objects toolbar to display a list of macros in the current macro directory, as well as options for listing the macro files in the **Examples** and **Macros** directories. Simply click to load the macro you want to use.

---



### Recording a Macro

Each operator you run from the Operator dialog box can be recorded in a macro for saving and later playback. This is useful for grouping common operations, or for creating an application macro that performs filtering, segmentation, measurement, and output tasks. For more information, see Recording a Macro.

## Running and Debugging a Macro

A full BasicScript execution and debug environment is included within Aphelion. This allows you to run macros, step through the instructions, and watch variable values. This can be used to catch problems in your macros, or as a demonstration method, where the steps of your demo are recorded in a macro and executed one at a time. For more information, see Macros.

## Creating Dialogs

BasicScript includes a complete dialog building environment. You can create a dialog and add buttons, type-in areas, pulldown lists, etc. This is useful for creating applications which present options to the user, such as three filtering options followed by measurement options. For more information, see Using the Dialog Editor.

# Aphelion Macros

The following macros are provided in the standard Aphelion distribution.

- Example Macros. The example macros provide examples of Aphelion features, such as file access and global measurements, and are stored in the directory \Aphelion\Examples.
- Application Macros. The application macros include image processing examples, such as color processing and morphology, and are stored in the directory \Aphelion\Macros.

We recommend that you run each macro and view the results. For an annotated version of Ceramic.apm, see Getting Started: Annotated Macro (Ceramic.apm).

---

**Tip:** To load a macro, click  on the Objects toolbar. The drop-down menu contains options for the **Macros** and **Examples** directories, as well as a list of all the macros in the default macro directory (determined by the last macro you opened).

- To load a macro from the Macros directory, choose **Macros** and then select the macro you want.
- To load a macro from the Examples directory, choose **Examples** and then select the macro you want.
- To load a macro from the default macro directory, select the macro from the list at the bottom of the menu.

For more information, see Loading a Macro.

---

## Example Macros

 The example macros are stored in the directory \Aphelion\Examples. To load an example macro, click the Macros button on the Objects toolbar, then choose **Examples**. Select the macro you want from the drop-down list.

Macro Name	Features highlighted in the macro
BrowseDirectory.apm	Browses an image directory from Visual Basic, looping on images
ColorImageAccess.apm	Shows how to access pixels in a color image from BasicScript.
ComplexImageAccess.apm	Shows how to access pixels in a complex image from BasicScript.

Dialog.apm	Displays a permanent dialog box to run an application
ExportToExcel.apm	Starts Excel and loads an image histogram into a worksheet
ExportToNotepad.apm	Starts Notepad and loads text
ExportToWord.apm	Starts Word and loads an image and text
FileAccess.apm	Demonstrates reading and writing a file from Basic
FrameGrabber.apm	Demonstrates various framegrabber functions
FuzzyClassifier.apm	Calls the Fuzzy Logic Classifier and computes scores from Basic.
GlobalMeasurements.apm	Computes a number of global image measurements
HistogramAccess.apm	Accesses the histogram values from Visual Basic
ImageAccess.apm	Reads and writes the pixels in an image from Basic
ImageFlickerView.apm	Demonstrates how to toggle the display between two images to compare them.
ImageRefresh.apm	Turns the display OFF in a macro to save time
ImgBoxes.apm	Turns regions into bounding boxes and filter them
ImgChains.apm	Starts with a gray level image and extract chains
ImgHistogramChart.apm	Uses chart functions to display an image histogram
ImgLines.apm	Starts with a gray level image and extract lines
ImgRead.apm	Prompts the user to select an image, and then loads and displays the image. This macro can be used as a prefix in another macro to load an image to process.
LineROI.apm	Creates processing Regions of interest (ROIs) which are derived from a line object set.
Lines2Regions.apm	Conversion of objects into regions for measurement purposes
ManageOverlay.apm	Shows how to get coordinates of various objects drawn in the overlay.
ObjectAccess.apm	Accesses attributes for an ISR object from Basic
ObjHistogramChart.apm	Uses chart functions to display an object histogram.
PrintPage.apm	Demonstrates printing functions from Basic
ProcessDialog.apm	Demonstrates a simple dialog that stays open while buttons are pressed to perform operations.
RegionMorphology.apm	Morphology performed on ISR regions
RegionRotate.apm	Rotation of ISR objects
Regions2Lines.apm	Fitting lines to ISR regions
ShowImageSequence.apm	Shows how to display a sequence of any 2D images.
ViewManipulation.apm	Moves and resizes image views

## Application Macros

 The application macros are stored in the directory \Aphelion\Macros. To load an application macro, click the Macros button on the Objects toolbar, then choose **Macros**. Select the macro you want from the drop-down list.

Macro Name	Features highlighted in the macro
------------	-----------------------------------

BasicExamples.apm	A variety of useful techniques using Basic
Blood.apm	Basic ISR object creation and measurements
Ceramic.apm	Basic image processing and ISR object techniques
Circuit.apm	Morphological operators to detect the defect
Color.apm	Color processing
Confocal.apm	RGB to HIS conversion
DemoDialog.apm	Dialog presenting a menu of applications demos
DemoLoop.apm	Loops to apply many operators to all images in a directory
FeretAccess.apm	Accesses the Feret diameters in an ISR object
Fourier.apm	Demonstrates various frequency domain filters
Granulo.apm	Granulometry computation, and automatic export to Excel
Grille.apm	ISR measurements and morphological operators
ImgRegister.apm	Registers an input image to a reference image.
Histology.apm	Color processing combined with morphology
ImmunoMarker.apm	Uses color information to detect cells
Muscle.apm	Morphological operators to detect cancerous cells
Road.apm	Computes boundary chains; demonstrates edgels, chains and lines
RoiProcess.apm	Demonstrates conversion of ISR regions to ROIs
SequenceInterface.apm	Uses a dialog for acquiring a sequence of images
WCCO.apm	Watersheds used to segment a multi-phase image

### Annotated Macro (*Ceramic.apm*)

This macro example is an annotated version of the macro Ceramic.apm. Ceramic.apm is one of the standard macros distributed with Aphelion. In this macro, the goal is to:

- Extract all the fibers (dark, circular objects)
- Measure the surface, elongation and compactness of each fiber
- Provide the position of the fibers in pixel coordinates

The image, Ceramic.tif, was obtained with a scanning electronic microscope. The pixel values range from 1 to 255. In this macro, the fibers are segmented from the background using a threshold. Morphological operators are used to clean the image. Local analysis is performed to get measurements on each fiber. From the measurement data, the fibers are filtered.

This macro also demonstrates how to use BasicScript, a Visual Basic compatible macro language, to create dialog boxes. The dialog boxes used in this macro are:

- YesNoDialog, to specify if the images are deleted at the end of the macro
- BreakTimeDialog, to specify the time lag between two Aphelion operators
- FilterBox, to select which filter to apply

#### Annotated Macro, Ceramic.apm

---

**Note:** In this example, the macro code appears in boxes, with the annotations in regular text. For more information about a specific Visual Basic command, refer to the *Macro Language Reference Guide*, available from the Help menu in Aphelion.

In Visual Basic, all comments made in a macro must start with a quote. An alternative is to use the rem command.

```
'-----  
'*          Ceramic.apm      *  
'-----  
'* Originator: GG           *  
'* Date of creation: 27/01/96 *  
'* Date of last modifications: 26/09/96 *  
'-----
```

Each subroutine must have a name. In Aphelion, the name by default is main, but any other name can be given to a subroutine. A subroutine can call another one, if the other subroutine is placed in the same file.

```
Sub main  
'-----  
'*          Declarations      *  
'-----
```

The following declarations define two integer variables, named breaktime and bt1000.

```
Dim breaktime As Integer  
Dim bt1000 As Integer
```

The following dialog box is defined using the Dialog Editor. This dialog box lets you delete all images and ObjectSets after you run the macro. The values 180 and 48 correspond to the size of the dialog box. The string "Aphelion Dialog Box" is the text which appears in the dialog box banner.

```
Begin Dialog YesNoDialog ,,180,48,"Aphelion Dialog Box"  
    OKButton 132,8,40,14  
    GroupBox 4,20,108,24,"",.GroupBox1  
    Text 4,8,108,8,  
    "Delete images and ObjectSets?",.Text1  
    OptionGroup .OptionGroup1  
    OptionButton 16,32,32,8,"YES",.OptionButton1  
    OptionButton 72,32,32,8,"NO",.OptionButton2  
End Dialog
```

The variable named ABox is defined as a dialog box of type YesNoDialog.

```
Dim ABox As YesNoDialog
```

When this dialog variable is used in a dialog call, it will appear in Aphelion as:



The following is the definition of a dialog box to specify break time. The variables OptionButton1, 2, 3 will contain the value 0 or 1, depending on the selection. Other numerical values correspond to the size and position of the OK and option buttons.

```

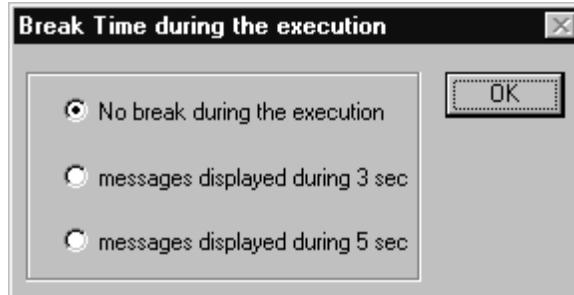
Begin Dialog BreakTimeDialog ,189,76,"Break Time during the execution"
    OKButton 144,8,40,14
    GroupBox 4,4,132,68,"",.GroupBox1
    OptionGroup .OptionGroup1
    OptionButton 16,16,108,8,_
        "No break during the execution",.OptionButton1
    OptionButton 16,36,116,8,_
        "messages displayed during 3 sec.",.OptionButton2
    OptionButton 16,56,116,8,_
        "messages displayed during 5 sec.",.OptionButton3
End Dialog

```

The variable named Breakbox is defined as a dialog box of type BreakTimeDialog.

```
Dim BreakBox As BreakTimeDialog
```

When this dialog variable is used in a dialog call, it will appear in Aphelion as:



The following is the definition of a dialog box to specify which filters will be performed on the ISR measurements. This dialog includes 4 check boxes, an OK button, and a Cancel button. All numerical values correspond to positions in pixels and sizes.

```

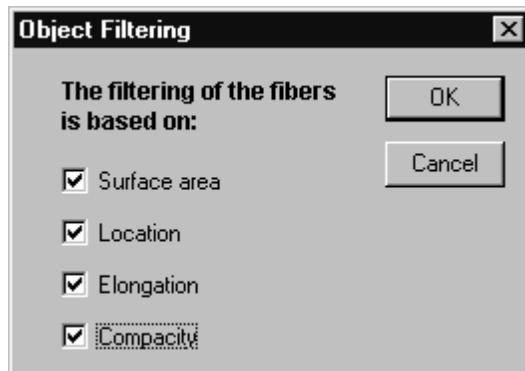
Begin Dialog FilterBox ,172,100,"Object Filtering"
    OKButton 124,8,40,14
    CancelButton 124,28,40,14
    Text 16,8,92,20,_
        "The filtering of the fibers is based on:",_
        .Text1,"Arial",9,ebBold
    CheckBox 16,36,68,8,"Surface area",.surface
    CheckBox 16,52,68,8,"Location",.location
    CheckBox 16,68,68,8,"Elongation",.elongation
    CheckBox 16,84,68,8,"Compactness",.compactness
End Dialog

```

The variable named FBox is defined as a dialog box of type FilterBox.

```
Dim FBox As FilterBox
```

When this dialog variable is used in a dialog call, it will appear in Aphelion as:



Aphelion supports both 4 and 8 connectivity. The two following variables are used for the labeling operation, to specify the number of neighbors of each pixel.

```
graph4C = AphNgbGraph( "2D 4-connected")
graph8C = AphNgbGraph( "2D 8-connected")
```

After all the declarations, the code begins.

```
'-----*
'          Main program
'*-----
```

First, the dialog box to select the time between two operators (break time) is displayed using the Dialog function and the BreakBox variable. This dialog returns two values, -1 if the OK button is pressed, or 0 if the CANCEL button is selected. As there is no CANCEL button, the dialog can only return -1. When the OK button is selected, the variable .OptionGroup1 tells which option has been selected. This variable can take three values, 0, 1 and 2.

```
response% = Dialog(BreakBox)
```

Use the CASE command to test a variable, and to branch to any line depending on the value. This is useful for handling the different button selections from a dialog.

```
Select Case response%
Case -1      ' OK button
    If BreakBox.OptionGroup1 = 0 Then
        breaktime = 0
    Else If BreakBox.OptionGroup1 = 1 Then
        breaktime = 3
    Else
        breaktime = 5
    End If
End If
Case 0      ' Cancel button
    MsgBox "Cancel button doesn't exist!"
End Select
```

All times in Visual Basic are given in milliseconds. Thus the number of seconds specified by the variable .OptionGroup1 is multiplied by 1000.

```
bt1000 = breaktime * 1000
```

Load the image ceramic.tif from disk and create a new image in Aphelion, using the AphImgNew operator. The full path to the image file has to be specified.

```
original = AphImgNew()
AphImgRead original, "c:\Aphelion\Images\Ceramic.tif"
```

The MsgOpen command will display a string in a pop-up box. The sleep command creates a pause depending on the time lapse defined. After opening a message window, you must close that window using the MsgClose command.

```
MsgOpen "Composite material in a ceramics matrix", breaktime, False, False
Sleep bt1000
MsgClose
```

The following are a number of messages to guide the user. The second message asks the user to specify threshold bounds of 1 and 117. Usually, the call to AphImgThreshold has three parameters, the two images and the bounds. As one of the three parameters has been omitted, Aphelion will prompt the user to enter those values. However, Visual Basic does not permit skipping the first parameters, and then specifying the last ones. If you want to let the user specify the first parameter, then do not specify any parameters in the call to the operator.

```

MsgOpen "The gray level histogram of this image includes two modes",
breaktime, False, False
Sleep bt1000
MsgClose
MsgOpen "A threshold will segment the two phases",
breaktime, False, False
Sleep bt1000
MsgClose
MsgOpen "Specify Low as 1 and High as 117", 0, False, False
Sleep 3000

```

The following lines show a threshold of the original image into a new image named Binary1. This name will appear in the window banner, and will also allow the user to work later on this image. The AphThreshold argument to AphImgThreshold is not specified as described above.

```

b1 = AphImgNew("Binary1")
AphImgThreshold original,b1
MsgClose
MsgOpen "Interactive gray level Thresholding", breaktime, False, False
Sleep bt1000
MsgClose

```

The binary image resulting from the threshold includes the fibers and also parts of the background (the darkest pixels). However, the fibers are much larger than the background noise, so you can apply a morphological dilation to the original gray scale image (with a structuring element whose size is greater than the size of the objects in the background, but smaller than the size of the fibers) to remove the darkest pixels.

The following lines perform a gray scale dilation of size 3, based on a square structuring element. The dilation is performed on the original image, and the output image is named Image1.

```

i1 = AphImgNew( "Image1" )
AphImgDilate original,i1,AphSElement( "Square" , 3 )

```

A new threshold is performed to extract the core of the fibers. The two bounds are set to 0 and 117. The threshold is performed on the result of the previous dilation, and the output image is named Binary2. Binary2 contains the seed points for the fibers, but not for the background noise.

```

b2 = AphImgNew( "Binary2" )
AphImgThreshold i1,b2,AphThreshold(0,117)

```

The following call to AphImgReconstruct performs binary reconstruction of the first binary image, using seeds detected after the second threshold. The output result will contain all blobs from the first threshold image which contain one or more seed pixels in the second threshold image. The binary reconstruction is based on the 4-connectivity, which means that every pixel in the binary image has four neighbors, in the 0, 90, 180 and 270 degree direction.

```

b3 = AphImgNew( "Binary3" )
AphImgReconstruct b1,b2,b3,graph4C

```

The following call to AphImgFree deletes the first two binary images, Binary1 and Binary2, which are not needed anymore.

```

AphImgFree b1
AphImgFree b2

```

Some of the fibers in the remaining binary image are connected. The use of binary segmentation operators based upon mathematical morphology techniques will segment all the fibers. The following lines call AphImgClustersSplitConvex, an operator based on the watershed algorithm.

```
b4 = AphImgNew( "Binary4" )
AphImgClustersSplitConvex b3, b4, 10, graph4C
```

Now AphImgHoleFill is used to fill the holes within blobs (fibers) in the previous binary image.

```
AphImgHoleFill b4, b4, graph8C
```

AphImgBorderKill will eliminate the objects intersecting the border of the image (partial fibers). Notice that both input and output images are identical. This feature is supported by Aphelion for all the operators which have input and output images of the same type. The operator is based on 4-connectivity.

```
AphImgBorderKill b4, b4, graph4C
```

The following AphImgClustersToLabels operator takes a binary image as input, and generates a labeled image. In the labeled image, each object has a different gray level value. All the pixels of the same connected object have the same value. The labels go from 1 to the number of objects. The first object is the first one hit while scanning the image from top to bottom and left to right. The connectivity is very important while performing a labeling.

```
l1 = AphImgNew( "Label" )
AphImgClustersToLabels b4, l1, AphNgbGraph( "2D 4-connected" )
AphImgFree b4
```

After a labeling, you can change the image representation and go from the pixel space to a symbolic representation. The ObjectSet named FIBERS is created after calling the Aphelion operator AphImgLabelsObj. The object FIBERS has a spatial representation of the fiber regions, and a few basic measurements, such as the number of pixels in each region. One way to examine this data is to use the grid feature available in Aphelion. A grid is similar to a spreadsheet, where each row corresponds to a label or object, and each column is an attribute or measurement.

```
AphImgLabelsObj l1, AphObjNew( "FIBERS" )
```

After creating the FIBERS objects, it is possible to analyze each region, and compute their convex hull from the region representation. This is the best way to compute the convex hull of objects, from their boundary representation.

```
AphRegionConvexHullPolygons AphObj( "FIBERS" )
```

The object FIBERS can be viewed in the grid, or the boundary of each object can be overlaid on the original image. The operator AphObjDraw overlays the object FIBERS, seen as polygons, on top of the image named original.

```
AphObjDraw original, AphObj( "FIBERS" ), "POLYGON"
```

The ObjectSet contains extensive information about the fibers. You can filter the objects based on their associated measurements, or use AphObjComputeMeasurements to compute many more attributes of the fibers.

PIXEL_COUNT	Number of pixels within each object
POLYGON.EXENTS.LL.X	Lower left X coordinates of the polygon extents
POLYGON.EXENTS.LL.Y	Lower left Y coordinates of the polygon extents
POLYGON.EXENTS.UR.X	Upper right X coordinates of the polygon extents
POLYGON.EXENTS.UR.Y	Upper right Y coordinates of the polygon extents
POLYGON.NUMPOINTS	Number of vertices in the convex hull of the object
REGION.EXENTS.LL.X	Lower left X coordinates of the region extents
REGION.EXENTS.LL.Y	Lower left Y coordinates of the region extents

REGION.EXTENTS.UR.X	Upper right X coordinates of the region extents
REGION.EXTENTS.UR.Y	Upper right Y coordinates of the region extents

The FBox dialog box lets the user to select which filter to apply. There are four types of filters available: surface, location, elongation, compactness.

```
response% = Dialog(FBox)
Select Case response%
Case -1           ' OK button
  If FBox.surface Then
    i1 = AphImgNew("Surface")
    AphImgCopy original, i1
```

The following line filters the ObjectSet FIBERS into a new ObjectSet named SURFACE. The attribute involved in the filtering is PIXEL\_COUNT. The lower and upper bounds are set respectively to 1000 and 1400.

```
AphObjFilter AphObj("FIBERS"), AphObjNew("SURFACE"), "PIXEL_COUNT", 1000, 1400
```

AphObjDraw will overlay the resulting ObjectSet on top of the original image.

```
AphObjDraw i1, AphObj("SURFACE"), "POLYGON"
End If
```

The following lines filter based upon the position of the objects in the image. As the lower labels are in the upper part of the image, it is sufficient to filter on the TOKEN\_INDEX variable. The two bounds are set to 1 and 10. A new ISR object named LOCATION is created.

```
If FBox.location Then
  i2 = AphImgNew("Location")
  AphImgCopy original, i2
  AphObjFilter AphObj("FIBERS"), AphObjNew("LOCATION"), "TOKEN_INDEX", 1,
10
  AphObjDraw i2, AphObj("LOCATION"), "POLYGON"
  MsgOpen "Selection of the 10 first fibers", breaktime, False, False
  Sleep 2000
  MsgClose
End If
```

The following lines filter based on the elongation of the objects. The elongation has to be measured on the regions, and not the boundaries. The two bounds of the filter are set to 0 and 0.05. A new ISR object named ELONGATION is created.

```
If FBox.elongation Then
  i3 = AphImgNew("Elongation")
  AphImgCopy original, i3
  AphRegionShape AphObj("FIBERS"), "REGION"
  AphObjFilter AphObj("FIBERS"), AphObjNew("ELONGATION"), "ELONGATION", 0,
0.05
  AphObjDraw i3, AphObj("ELONGATION"), "POLYGON"
  MsgOpen "Fibers with elongation between 0 and 0.05", breaktime, False,
False
  Sleep 2000
  MsgClose
End If
```

The following lines filter based on the compactness of the objects. The first call to AphObjAttributeRatio generates a new attribute named A1 which is equal to the PERIMETER divided by the AREA of each object. The second call defines a new attribute A2 equal to A1 divided by the PERIMETER, or the AREA divided by the square of the PERIMETER. The compactness is defined from this ratio. The two bounds of the filter are set to 0.045 and 0.06. This filter shows how new attributes can be defined from already computed ones. For further information on creating new attributes from BasicScript see the Obj macro functions. The final result is displayed on top of the original image.

```

If FBox.compactness Then
  i4 = AphImgNew("Compactness")
  AphImgCopy original, i4
  AphRegionShape AphObj("FIBERS"), "REGION"
  AphObjAttributeRatio AphObj("FIBERS"), "PIXEL_COUNT", "PERIMETER", "A1"
  AphObjAttributeRatio AphObj("FIBERS"), "A1", "PERIMETER", "A2"
  AphObjFilter AphObj("FIBERS"), AphObjNew("COMPACTNESS"), "A2", 0.045, 0.06
  AphObjDraw i4, AphObj("COMPACTNESS"), "POLYGON"
  MsgOpen "Fibers whose shape is close to a circle", breaktime, False, False
  Sleep 2000
  MsgClose
End If
Case 0      ' Cancel button
  MsgBox "Cancel button doesn't exist!"
End Select

```

This dialog box asks whether to delete all the images created by running this macro. The first choice is the deletion of all the images, and the value of the .OptionGroup1 is then 0. The variable response% is the returned value of the dialog box.

```

response% = Dialog(ABox)
If ABox.OptionGroup1 = 0 Then
  AphImgFree original

    if (i1<>0) then
      AphImgFree i1
      AphObjFree AphObj("SURFACE")
    end if

    if (i2<>0) then
      AphImgFree i2
      AphObjFree AphObj("LOCATION")
    end if

    if (i3<>0) then
      AphImgFree i3
      AphObjFree AphObj("ELONGATION")
    end if

    if (i4<>0) then
      AphImgFree i4
      AphObjFree AphObj("COMPACTNESS")
    end if

  AphObjFree AphObj("FIBERS")
End If

```

This is the end of the macro and the subroutine main. The call to the function End Sub ends the subroutine.

```
End Sub
```

## Aphelion Graphical User Interface

The Aphelion graphical user interface (GUI) provides a workspace for displaying images and other kinds of documents, and the tools to work with those documents. The main workspace includes a menu bar, Main toolbar, and Objects toolbar. When you first start Aphelion, the Operator dialog box and tabbed Information/History/Messages window are also open.

You can rearrange elements of the interface to provide more workspace to display images, charts, and other documents. For information about customizing the workspace, see Customizing Aphelion.

The Aphelion workspace displays the following types of windows:

- Image

- Acquisition image (for use with cameras)
- Chart
- Grid
- Text
- Macro
- OLE
- Error message

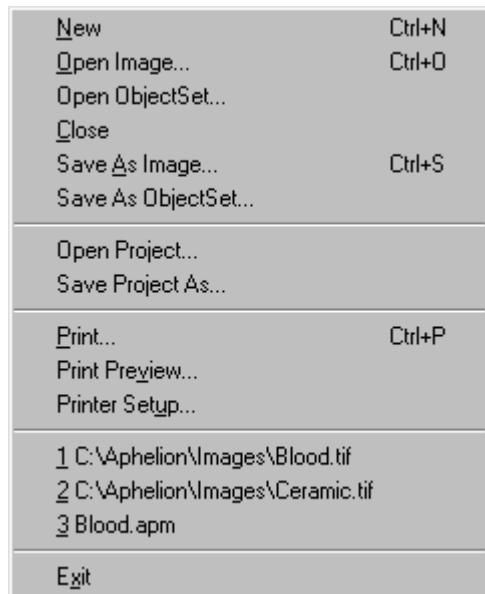
Depending on what type of window is active, the corresponding toolbar is displayed. For example, when you open an image window, the Image toolbar appears along the right side of the screen.

## Menu Bar

The menu bar runs along the top of the Aphelion screen. The menus provide convenient access to Aphelion commands.

**File Edit View Options Window Help**

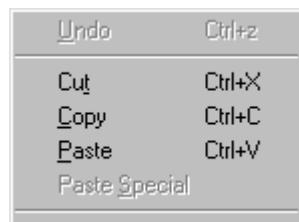
### **File Menu**



Use the **File** menu to create a new file, open a file, save a file, print a file, select one of the last files opened, open and save a project, and exit Aphelion.

The **File** menu also includes a numbered list of recently opened files. To open one of these files, type the number or highlight the file and press **Enter**.

## Edit Menu



Use the **Edit** menu to work with overlay objects and ROIs.

Use the **Cut** command on the **Edit** menu to remove overlay objects and ROIs from an image. To cut, copy, and paste images, see AphImgCut, AphImgCopy, and AphImgPaste.

Use the Undo command to reverse certain commands or delete the last entry you typed. If the Undo command is grayed (not available), then you cannot undo the last action.

## View Menu



Use the **View** menu to adjust the way some features of the interface are presented, such as hiding or displaying toolbars. You can also control the way certain statistics, pixel values, and output measurements are displayed.

You can:

- Display or hide toolbars that are displayed in Aphelion. Click to hide or display the Main toolbar, Objects toolbar, or Status Bar. For more information about adjusting the workspace in Aphelion, see Customizing Aphelion.
- Indicate what information should be displayed in the Info Window. For more information, see Information (Info) Page.
- Change the language in which the interface is displayed. The Aphelion user interface currently supports the English, French, and Kanji languages. The menu bar, tooltips, pop-up menus, operator parameters, and Aphelion messages are translated. For more information, see Multiple Language Documentation.

## Options Menu

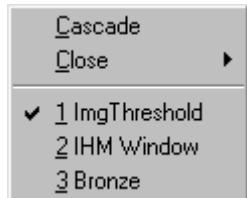


Use the **Options** menu to set Aphelion defaults. Use **Preferences** to set the default pixel aspect, to indicate whether images and a history of commands are saved in a project, and to automatically open the last project when you start Aphelion. You can also control some display properties, such as whether a grid is automatically displayed when an ObjectSet is created. For more information, see Preferences.

Use **Charts** to specify a model file to be used with a specific type of chart (histogram, profile, surface map, or scatter plot). For more information, see Creating a Chart Model.

Use **Background** to set the background color of the Aphelion workspace.

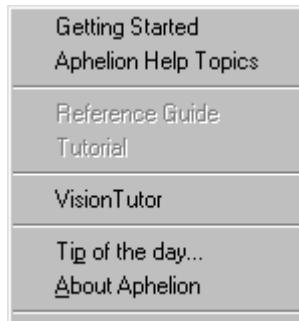
## Windows Menu



Use the **Windows** menu to manage the display of windows in Aphelion. You can use **Cascade** to display all open windows in a cascade. You can use the **Close** command to close image, chart, or grid windows. The Close command does not apply to macro windows.

The **Windows** menu also includes a numbered list of open windows. To focus on one of these windows, type the number or highlight the name and press **Enter**.

## Help Menu



Use the **Help** menu to access online Help. The Getting Started command takes you directly to the online version of the Getting Started Guide. The Aphelion Help Topics command displays the Index tab for all Aphelion online documentation, including the *Aphelion Reference Guide* and the *Aphelion Developer Guide*.

For more information, see Online Help.

## Statusbar

The Statusbar provides information about the active window, virtual screen, or interface element. The information provided is a function of the position of the mouse. You can view:

- Quick Help, on the left end of the Statusbar. Depending on where the cursor is positioned, Quick Help displays:
  - A brief description of a toolbar button or menu item
  - A brief description of each operator listed on the drop-down Operator list in the Operator dialog box.
  - The position and value of a pixel
  - The position of an ROI or a graphic overlay object

Draws a round rectangle using default line width and color

(113, 33) = 88.0000

For example, the position and value of a pixel are displayed based on the position of the mouse cursor. For a color image, the Statusbar displays pixel coordinates and the RGB values.

## Toolbars

### Main Toolbar

The Main toolbar is displayed just below the menu bar when you open Aphelion. If you want to hide the Main toolbar, choose **View→Main toolbar**.



**New Document** - Create a new document window. You specify the kind of document you want to create: macro, grid, text, or OLE.



**Open Image** - Open a previously saved image.



**Save As Image** - Save the currently selected image.



**Cut** - Cut an object and place it onto the Clipboard. You can use the Cut button to cut information from an image, macro, or text window. You must first select the material you want to cut before the Cut button becomes available.

To cut information in any tab in the Info/History/Messages window, use the contextual pop-up menus.



**Copy** - Copy an object and place it onto the Clipboard. You can use the Copy button to copy information from an image, macro, or text window. To copy information in any tab in the Info/History/Messages window, use the contextual pop-up menus.



**Paste** - Paste an object from the Clipboard into an image, text, or macro window. Currently, you can paste overlay objects from an image window or text from a macro or text window. To paste information in any tab in the Info/History/Messages window, use the contextual pop-up menus.



**Help** - Display Aphelion online Help.



**Context Help** - Display context-sensitive Help for menus, buttons, and other interface elements. Click this button, then click the object for which you want Help. Aphelion displays a pop-up window with a brief description of the object. To close the pop-up window, simply continue with your work.

### Objects Toolbar

The Objects toolbar is displayed when you open Aphelion. If you want to hide the Objects toolbar, choose **View→Objects bar**.



**Operator Dialog Box** - Display or hide the Operator dialog box.



**Info/History/Messages Window** - Display or hide the Info/History/Messages window.



**Print Page Design** - Layout images, text, and other objects on a page for printing.



**Image List** - List the images that reside in all of the virtual screens, and images that were opened but are now closed. Click the image of interest. If the image was closed, it will reopen into the virtual screen selected. If the image is open, it will be

selected.



**Graph List** - List the graphs and charts that reside in all of the virtual screens, and charts that were opened but now are closed. Click the chart of interest. If the chart was closed it will reopen into the virtual screen selected. If the chart is open, it will be selected.



**ObjectSet List** - List all ObjectSets that have been created as a result of segmentation routines.



**Camera Definition** - Displays a list of camera parameters.



**Virtual Screen Filer** - Opens a Virtual Screen Filer dialog box with a diagram of the contents of all virtual screens.



**Message Passing** - Open the Message Passing dialog box, to set up message passing between image windows. Currently supported messages are zoom and scroll.



**Macros** - List macros from the Macros, Examples, or default macro directory. Modify the Macro Library.



**Attach Macro** - Open a dialog box that lets you attach up to four macros and up to two applications to the toolbar.



**M1 - M4** - Shortcut button for running a macro. You first must attach a macro to one of the four buttons using the Attach Macro to Toolbar dialog box.



**A1 - A2** - Shortcut button for accessing an application. You first must attach an application to one of the two buttons using the Attach Macro to Toolbar dialog box.



**Show Demos** - Play multi-media demos and tutorials that provide an introduction to Aphelion interfaces, concepts, and algorithms. The files can be played directly from the CD by dragging one of the .scm files onto the scplayer program. Or, for more convenience, copy the Demos sub-directory to the Aphelion installation directory in order to make the demos available from the ShowDemos button.

## **Image Toolbar**

When an image window is active, the Image toolbar appears along the right side of the screen. The **Select Objects** and **Graphics Overlay** buttons are selected by default.



**Select Objects** - Lets you select an object, and displays handles along the outline of the object. Overlay objects can be selected in any image window.



**Draw Point** - Lets you draw a point in any image window. To move a point, first select it, then drag the point to a new position. For more information, see Point Overlays.



**Draw Line** - Lets you draw a line in any image window. To move the line, first select it, then drag the line to a new position. The Draw Line button is automatically activated when you click the Profile button.



**Draw Rectangle** - Lets you draw a rectangle. Rectangular objects may be drawn (overlaid) onto images. To move the rectangle, first select it, and then drag the rectangle to a new position. Click the right mouse button to display the rectangle pop-up menu.



**Draw Round Rectangle** - Lets you draw a rounded rectangle. Rounded rectangle objects may be drawn (overlaid) onto images. To move a Round Rectangle, first select it, then drag the rounded rectangle to a new position. Click the right mouse button to display the rounded rectangle pop-up menu.



**Draw Ellipse** - Lets you draw an ellipse. Ellipse-shaped objects may be drawn (overlaid) onto images. Click the right mouse button to display the ellipse pop-up menu.



**Draw Polygon** - Lets you draw a polygon. Polygon objects may be drawn (overlaid) onto images. Click the right mouse button to display the polygon pop-up

menu.



**Freehand Draw** - Lets you draw in an image using a pen. This pen can be used for changing pixel values, splitting or connecting objects, or marking objects for a binary and manual segmentation.



**Draw Text** - Lets you add text to an image. You can set font, text color, and background color of the text box.



**Zoom In** - Zoom in on a selected area. Click **Zoom In**, then draw a rectangle over the area you want to zoom in on. You can repeat this procedure to zoom in further on an area.



**Reset Zoom** - Return an image to its previous magnification. Click the Reset Zoom button (or press **CTRL-Z**) as many times as necessary to return to the original display.



**Select Fill Color** - Display a dialog box from which you can select a fill color for drawn objects.



**Select Line Color** - Display a dialog box from which you can select a line color.



**Select Line Width** - Display a dialog box from which you can select a line width.



**Select Font** - Display a dialog box from which you can select a font for the text in a document (not available).



**Overlay** - Display a pop-up list of overlay modes:

- Graphic
- ROI
- Profile
- Histogram

## Grid Toolbar

The Grid toolbar appears along the right side of the screen when a grid window is active.



**ISR Histogram** - Draw a histogram of selected data. Highlight the column in the Grid that represents the data set (ObjectSet attribute) of interest, then click . A chart window opens, displaying the histogram.



**Sort by Index** - Sort the grid by index number (first column).



**Sort by Column** - Sort the grid by the currently selected column.



**ShowInfo** - Display the following ObjectSet information in the last five rows of the Grid: units, minimum, maximum, mean, standard deviation.

## Chart Toolbar

The Chart toolbar is displayed along the right side of the screen when a chart window is active. Charts include histograms, profiles, surface maps, and scatter plots.



**Plot** - Set the presentation type to a line plot.



**Area Chart** - Set the presentation type to a filled plot.



**3D bar chart** - Set the presentation type to 3D bar.



**Move** - Move the chart within the chart window.



**Scale** - Increase or decrease the size of the chart. Click the Scale button, then drag the cursor up to increase or down to decrease the size of the chart.



**Zoom In** - Zoom in on a selected rectangular area. Click this button again to turn off zooming.



**Reset** - Reset the chart to its original presentation, location, and size.

## Macro Toolbar

The Macro toolbar is displayed along the top of the macro window.



**Run Macro** - Begin execution of a macro.



**Stop Execution** - Pause execution of a macro. The pointer appears on the line of code where the macro stopped executing. This is the line of code to be executed next. Click the **Run Macro** button to continue execution.



**Stop Debug** - Stop execution of a macro.



**Set/Unset Break Point** - Add or remove a breakpoint on a line of code. Click on any line within the macro and then click on this icon to set a breakpoint. To unset a breakpoint, click on a line where the breakpoint was already set and click on this icon.

To clear all break points, right-click in the macro window and choose **Debug:Clear Break Points**.



**Add Watch** - Display the Add Watch dialog box, in which you can specify a variable. This variable, together with its value (if any), is then displayed in the watch area of the Macro window. It allows you to check the value of variables for loops, test conditions, etc.



**Step Into** - Execute the next line of a macro and then suspend execution of the macro. If the macro calls another macro, execution will continue into each line of the procedure.



**Step Over** - Execute the next line of a macro and then suspend execution of the macro. If the macro calls another macro, the called procedure will run in its entirety.



**Start Recording** - Once the record mode has been selected, each action in the GUI is recorded as a line of Basic code. When you click this button, the current macro window is cleared and a new macro window appears with the command `Sub main`. Be sure the current code has been saved before you record a new macro.



**Stop Recording** - Stop recording a macro. When you click this button, the command `End Sub` is automatically appended to the end of the recorded code.



**Keyword Help** - Display context-sensitive online Help for macro functions. Make sure that you click on the command, Aphelion operator, or Aphelion function for which you want Help before clicking the Help button.

## Acquisition Toolbar



**Grab Image** - Start acquisition of an image.



**Freeze Image** - Freeze an image.



**Snap Image** - Snap an image.



**Set Gain/Offset** - Display the Gain/Offset dialog box and adjust the image in real time.

- |   |   |
|---|---|
|  | <b>Input LUT</b> - Select the input LUT for a live image.               |
|  | <b>Statistics on Live Image</b> - Display the mean in the Statusbar.    |
|  | <b>Histogram on Live Image</b> - Display a histogram of the live image. |

## Pop-up Menus

In various areas and windows of the Aphelion interface, you can click the right mouse button to display a pop-up menu. Each pop-up menu lists commands pertaining to the area of the screen where the mouse cursor is positioned.

### *Image Pop-up Menu*

To display the Image pop-up menu, right-click anywhere in an active Image window.

<b>View</b>	Change the pixel aspect for the active image. Select Pixel=Point, Aspect Ratio, or Window Size. To change the default pixel aspect, use the <b>Options→Preferences</b> command. See <a href="#">Modifying the Image View</a> and <a href="#">Modifying the Default Image View</a> .  For color images, you can also select whether to display all bands (default), or the first, second, or third bands only.
<b>Properties</b>	Modify image properties, such as image type, display context, or lookup table (LUT). <ul style="list-style-type: none"> <li>• Properties (See <a href="#">Image Properties</a>.)</li> <li>• Calibrate (See <a href="#">Calibrating an Image</a>.)</li> <li>• Contrast/Brightness (See <a href="#">Adjusting the Contrast/Brightness</a>.)</li> <li>• Select DC (See <a href="#">Selecting the Display Context</a>.)</li> <li>• Select LUT (See <a href="#">Selecting the LookupTable</a>.)</li> </ul>
<b>Operators</b>	Apply one of the following commands to the active image: <ul style="list-style-type: none"> <li>• Free this image. Free the image from Aphelion memory. See <a href="#">AphImgFree</a>.</li> <li>• Surface Map. Create a surface map. See <a href="#">Image Surface Maps</a>.</li> <li>• Histogram. Create a histogram of the entire image. See <a href="#">Image Histograms</a>.</li> <li>• Statistics - Display the following information in the Info tab of the IHM Window: <ul style="list-style-type: none"> <li>• Minimum</li> <li>• Maximum</li> <li>• Mean</li> <li>• StdDev (Standard Deviation)</li> <li>• Skewness</li> <li>• Kurtosis</li> </ul> </li> </ul>
<b>Graphic</b>	Modify properties of the selected graphic. See <a href="#">Graphic Overlays</a> and <a href="#">Converting Graphic Overlay Objects to ROIs</a> .
<b>ROI</b>	Enable, disable, or delete ROIs associated with the active image. See <a href="#">Disabling and Enabling an ROI</a> and <a href="#">Deleting ROIs</a> .
<b>Profile</b>	Change the line color of a selected profile line in an image window. See <a href="#">Modifying an image profile</a> .

<b>Histogram</b>	Change the line color of a histogram rectangle drawn in an image window. See <a href="#">Modifying an image histogram</a> .
------------------	--

## Grid Pop-up Menu

To display the Grid pop-up menu, right-click anywhere in an active Grid window.

---

**Note:** You can also access the Histogram, Sort by Index, Sort by Column, and Show Info commands from the Grid toolbar. See Grid Toolbar.

---

<b>Load</b>	Display a list of ObjectSets. Select the ObjectSet you want to load.
<b>Attach to Graphic</b>	Set up a message passing link between one column (attribute) in the Grid document and an ISR histogram window. Select a column, then choose Attach to Graphic. Choose New to create a chart, or select an existing chart.
<b>Histogram</b>	Draw a histogram of selected data. Highlight the column in the Grid that represents the data set (ObjectSet attribute) of interest, then choose <b>Histogram</b> . A chart window containing the histogram opens.
<b>Scatter</b>	Draw a scatter plot, made up of two attributes. The scatter plot is displayed in a chart window. The title bar of the chart window displays the name of the grid and the two ObjectSet attributes that the scatter plot is based on.
<b>Export to Excel</b>	Create an embedded Excel document and load the ObjectSet data into it.
<b>Delete Column</b>	Delete any selected columns. You can delete columns of scalar attributes only. You cannot delete columns containing spatial attributes.  To select a column, click on the heading for the column. To deselect a column, click on the heading again.
<b>Delete Rows</b>	Delete any selected rows. To select a row, click on the index number (first column) for the row. To deselect a row, click on the index number again.
<b>Keep Rows</b>	Display only the selected rows. To select a row, click on the index number (first column) for the row. To deselect a row, click on the index number again.  <b>Caution:</b> Choose <b>Keep Rows</b> only if you have selected one or more rows. Otherwise, the grid will be cleared and the data will be lost.
<b>Sort by index</b>	Sort by index number (first column).
<b>Sort by column</b>	Sort the currently selected column.
<b>Show Info</b>	When this command is checked, the last five rows of the Grid Document display the following ObjectSet information: units, minimum, maximum, mean and standard deviation.

## Chart Pop-up Menu

To display the Chart pop-up menu, right-click anywhere in a histogram, profile, or surface map, or scatter plot window.

<b>Properties</b>	Display the Olectra Chart Control Properties dialog box. You can change the titles of each axis, the color of the various areas of the chart, and other aspects of the display. See Setting Chart Options.
<b>Save Model</b>	Save the properties of the current chart as a model. You can use the model when you create other charts. To specify which model you want to use for a particular type of chart, choose <b>Options→Chart</b> from the Aphelion menu bar.
<b>Save Chart</b>	Saves the chart description and the data. For more information, see Charts.
<b>Load Chart</b>	Load a chart file that you previously saved.
<b>Show Maximum</b>	Mark the peaks of the plot.
<b>Show Minimum</b>	Mark the valleys of the plot.
<b>Print</b>	Print the chart. Choose from the following options: <ul style="list-style-type: none"> <li>• Same Size</li> <li>• Using Width</li> <li>• Using Height</li> <li>• Best Fit</li> <li>• Full Page</li> </ul>
<b>Clipboard</b>	Put a copy of the chart on the clipboard.
<b>Save As Bitmap</b>	Save the chart as a bitmap.
<b>Set Defaults</b>	Set the default for the size and position of a particular type of chart. Move the window to the size and position you want to establish as the default, then click <b>Set Defaults→Size</b> and <b>Set Defaults→Position</b> . You set the size and position separately. The next time you open a chart of that type, it will use the default size and position.  <b>Note:</b> To save defaults for charts in a project, make sure that you choose <b>Options→Preference</b> from the menu bar, then select <b>Save Images in the project</b> .
<b>Selection</b>	When using dynamic coloring, delete or change the color of a selected area of a chart. <ul style="list-style-type: none"> <li>• Delete selection. Delete the selection where the mouse cursor is positioned.</li> <li>• Delete all selections. Use this command to clear all ranges used in dynamic coloring. For more information, see Using the Histogram Command.</li> <li>• Color. Change the color of the current selection.</li> </ul>

## Macro Pop-up Menu

To display the Macro pop-up menu, right-click anywhere in an active macro window.

---

**Note:** On some PCs, you may need to right-click in the area of the Macro toolbar to display the Macro pop-up menu.

<b>Load</b>	Load a macro. You can also use the Macro List button on the Objects toolbar to load a macro. See Loading a Macro.
-------------	---

<b>Save</b>	Save a macro. See Saving a Macro.
<b>Save As</b>	Save a macro with a new name. In the Save As dialog box, type the name of the macro in the File name field. Macro files have the extension .apm. If you forget to save a macro, Aphelion automatically saves the macro in the Aphelion\tmp subdirectory. See Saving a Macro.
<b>Edit</b>	Edit a macro. See Editing a Macro for more information. <ul style="list-style-type: none"> <li>• Clear</li> <li>• Cut</li> <li>• Copy</li> <li>• Paste</li> <li>• Undo. You can click Undo (or press CTRL+SHIFT+Z) multiple times to reverse multiple actions.</li> </ul>
<b>Debug</b>	Debug a macro. See Debugging a Macro for more information. <ul style="list-style-type: none"> <li>• Calls</li> <li>• Clear Break Points</li> </ul>
<b>Dialog Editor</b>	Use the dialog editor to create dialog boxes. You can edit an existing dialog box or create a new one. <ul style="list-style-type: none"> <li>• Edit Dialog</li> <li>• New</li> </ul> See Using the Dialog Editor.
<b>Font</b>	Modify the font used in the macro window. You can modify the font for the entire macro, not for selected text. See Editing a Macro.
<b>Add to Macro Library</b>	Add the current macro to the Macro Library. The macro library makes it possible to call one macro from another, or pass arguments to a macro. See Macro Library.
<b>Find</b>	Find a string in the current macro. If the macro window is selected, you can also use <b>CTRL-F</b> to open the Find dialog box.

## Opening New Documents



You can open a new Grid, Macro, or Text document from the Main toolbar or from the New command on the File menu.

---

**Note:** To open an Image, use the **Open Image** command on the File menu.

---

1. From the **File** menu, choose **New**. The New dialog box opens.
2. Select the type of document you want to open.
  - Grid
  - Macro. This option is especially useful for recording a new macro or for loading an existing macro (and thereby changing the default macro directory).
  - Text
  - OLE. This option is currently unavailable.
3. Click **OK**. The corresponding window opens. At this point, the window is empty.
  - For macros and text files, you can load an existing file or create a new one.

- For Grid files, you can load an existing file.

To load an existing file, click the right mouse button and choose **Load**.

You can also use the following keyboard shortcuts to open an existing document in a new window:

<b>Document Type</b>	<b>Shortcut</b>
Image	CTRL-O
Macro	CTRL-M
Text	CTRL-T

## Aphelion File Extensions

.ap	Project
.apb	History
.apc	Chart model
.apm	Macro
.oc2	2-dimensional chart
.oc3	3-dimensional chart
.rls	Rule Set
.tks	ObjectSet
.txt	Text files

## Customizing Aphelion

There are several ways you can customize Aphelion, so that your Aphelion sessions will be as efficient and productive as possible.

### Customizing Your Workspace

- Customize the list of operators that you use frequently. See List of Frequently Used Operators.
- Create custom macro and application buttons. See Attaching a Macro or Application Button to the Toolbar.
- Create Chart models for displaying histograms, profiles, surface maps, and scatter plots. See Creating a Chart Model.
- Turn off the Tip of the Day.
  1. From the Help menu, choose Tip of the day.
  2. Clear the **Show Tips on Startup** check box.
  3. Click **Close**.
- Hide or display the Operator dialog box and the IHM window

- To hide or display the Operator dialog box, click the  button on the Objects toolbar.
- To hide or display the IHM window, click the  button on the Objects toolbar.
- Change the language in which the Aphelion interface is displayed. See Multiple Language Documentation.
- Change the background color of the workspace. See Options Menu.

## Startup Options

When you startup Aphelion, you can specify that you want to:

- run a specific macro automatically
- open Aphelion in a maximized window
- load the last project you were working on

### ***Running a Macro***

You can set up Aphelion so that it runs a macro each time you start the application.

1. Create a macro named **Aphelion.apm**.
2. Save the Aphelion.apm file in the Aphelion\Macros directory.

The next time you start Aphelion, the macro will run automatically.

### ***Starting Aphelion in a Maximized Window***

If you want the Aphelion window to open maximized each time you start Aphelion, make the following change to the Registry.

---

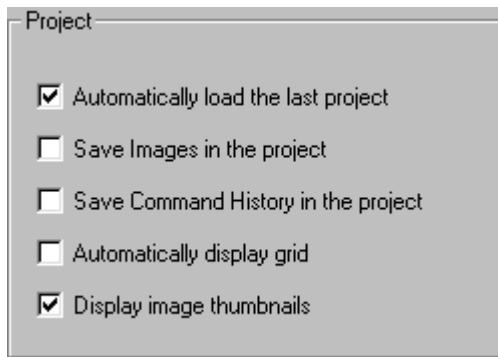
**Note:** Changing the Registry is recommended for advanced Windows users only.

1. Click **Start:Run**. Choose or type **Regedit**.
2. Choose HKEY\_CURRENT USER. Then choose Software→ADCIS-AAI→Aphelion→2.3→Format→Aphelion.
3. In the right pane of the Registry window, right-click and choose New→DWORD Value.
4. Type **Maximize** as the name for the new value.
5. To maximize the Aphelion window on startup, right-click on the name Maximize and choose **Modify**.
6. Type **1** in the Value Data field. (To change back to the default position, type **0**.)
7. Click **OK**. The next time you start Aphelion, it will open as a maximized window.

### ***Loading a Project***

You can set up Aphelion so that the project you were working on when you exited Aphelion will be opened automatically when you restart Aphelion.

1. From the **Options** menu, choose **Preferences**. The Preferences dialog box is displayed. The section for setting Project preferences is at the bottom of the dialog box.



2. Select the option, Automatically load the last project.
3. Click **OK**.

## Preferences

From the Options menu on the Main toolbar, you can specify preferences for how images are displayed in Aphelion and for how you use projects.

- Default Image View
- Project Preferences

For more information about viewing an image, see Image Views.

For more information about projects, see Aphelion Projects.

### ***Modifying the Default Image View***

When you first start Aphelion, the default image view is set to maintain the aspect ratio of images. This means that all images are opened with the image view set to **Aspect Ratio**. You can modify the default image view at any time.

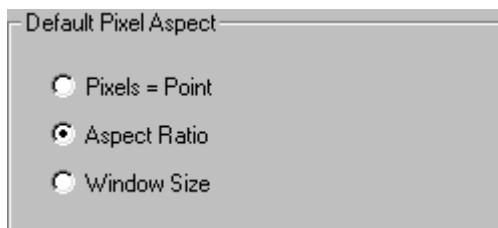
---

**Note:** To change the image view for a specific image, use the **View** command on the Image pop-up menu. See Resizing an Image.

---

#### To modify the default image view

1. From the **Options** menu, choose **Preferences**. The Preferences dialog box is displayed. The section for setting the Default Pixel Aspect is at the top of the dialog box.



2. Click the radio button to choose one of the following options:

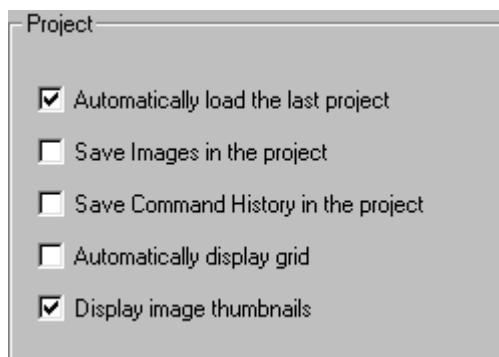
- To indicate that an image window cannot be resized beyond the pixel size of its x and y axis, choose **Pixel=Point**. If the size of the window is smaller than the size of the image, scroll bars will be displayed.
  - To maintain the aspect ratio of the image, choose **Aspect Ratio**.
  - To allow each axis of the window to be resized independently, choose **Window Size**.
3. Click **OK**.

### **Setting Project Preferences**

Use the Preferences dialog box to customize what is saved in a project file. For example, you might choose not to save images in projects if you want to save disk space.

#### **To set project preferences**

1. From the **Options** menu, choose **Preferences**. The Preferences dialog box is displayed. The section for setting Project preferences is at the bottom of the dialog box.



2. Select or clear the following options:
  - Automatically load the last project. If you select this option, Aphelion automatically loads the last project you were working on. If you do not select this option, the **untitled.ap** project is loaded. **Default:** Off
  - Save Images in the project. **Default:** Off
  - Save Command History in the project. **Default:** Off
  - Automatically display grid while running an AphObj operator. Automatically open a grid when you run an operator that creates an ObjectSet. **Default:** Off
  - Display image thumbnails. This option allows you to display images as thumbnails in the Operator dialog box. If you are dealing with large images, turn off this option to improve processing time. **Default:** On

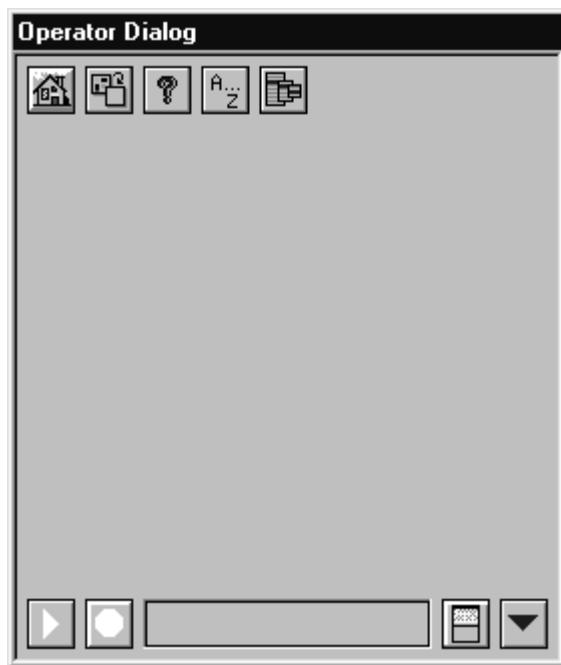
3. Click **OK**.

---

**Note:** If you save images and history in the project file, you may notice that it takes a long time for Aphelion to start. This may mean that the project file has become too large. You should clear the History pane and the saved images:

- To clear the history, right-click in the History pane and select **Clear**.
  - To clear the images, run AphImgFreeAll from the Operator dialog box, then exit Aphelion.
-

# Operator Dialog Box



The Operator dialog box is used to apply Aphelion operators to images and symbolic data sets. The Operator dialog box is open when you first start Aphelion.



Use the ShowOpDialog button on the Objects toolbar to hide or display the Operator dialog box. You can use the mouse to drag the Operator dialog box to a different location. The Operator dialog box cannot be resized.

## Displaying Results for Global Analysis Operators

When you select a global analysis operator, such as AphImgVolume, the button appears in the Operator dialog box. This button allows you to indicate if you want the output displayed in the Info window. For AphImgHistogram, AphImgBandHistogram, and AphImgProfile, you can also choose to display the output in a Profile or Histogram window or export the output to an Excel spreadsheet.

### Example

1. Select AphImgHistogram.
2. Click the Results button.
3. Choose one or more of the options:
  - View Output in Info Window
  - Create Profile/Histogram Window
  - Export to Excel
4. Click the Run Operator button to run the operator. The results will appear according to the options you chose.

---

**Note:** When you choose an input image for AphImgProfile, the chart window is displayed automatically. If you chose Export to Excel, you must click the Run Operator button to export the results to an Excel spreadsheet.

---

## Running an Operator

The following procedure outlines the steps to select and run an operator.

---

**Note:**  To interrupt the execution of an operator, click the Stop Operator button. When the Stop Operator button turns white, the execution is complete.

---

1. Open the images you want to work with.
2. Select an operator. To view online Help for the currently-selected operator, click  in the Operator dialog box.
3. Specify an input image and an output image.  
You can click the image icons and select an image from the pop-up list, or use the drag-and-drop feature from the Virtual Screen Filer.  
Note: If you do want to display images as thumbnails in the Operator dialog box, choose **Preferences** from the **Options** menu and deselect **Display image thumbnails**. This is especially useful when dealing with large images.
4. Make any necessary changes to the parameters. The input and output images you select may affect the default values of the parameters, as well as the valid ranges or constraints. Most parameters are set to default values which you can modify.
5.  To run the operator, click the Run Operator button. The progress bar indicates the status of the Operator execution.

---

**Shortcut:** To run an operator, press **CTRL-R**.

---

6. View the results.

For global analysis operators, you can choose to view the results in the Info tab of the IHM window, in a chart, or in an Excel spreadsheet.

## Operator Toolbars

The Operator dialog box has two toolbars; one at the top of the dialog box and one at the bottom.

The buttons in the toolbar at the top of the Operator dialog box are used to select operators and to access Help for the current operator.

	<b>Frequently Used Operators</b> - Maintain or use a list of frequently used operators.
	<b>ImgFreeAll</b> - Run the ImgFreeAll operator. Aphelion displays a message box asking you to confirm that you want to delete all open images. Click <b>Yes</b> to free all open images.
	<b>Operator Help</b> - Access online Help for the currently selected operator.
	<b>Select Operator (alphabetical)</b> - Display a dialog box for selecting an

	operator from an alphabetical list.
	<b>Select Operator</b> - Display a series of menus, with Operator categories and subcategories, for selecting an operator.
	<b>MMX</b> - If you use a PC with an MMX chip from Intel, some Aphelion operators will execute on the MMX. Use of the Intel MMX coprocessor will dramatically improve the speed of these operators. If an operator can run on the MMX, a flag icon appears in the right corner of the Operator dialog box. The user may select either to run the operator in the MMX, or in the general purpose processor of the PC.  To use MMX acceleration, an optional extension has to be installed from the Aphelion Setup menu. Please see the "Release Notes" for more information on the MMX installation.

The toolbar buttons at the bottom of the Operator dialog box are used to run an operator.

	<b>Run Operator</b> - Run the currently selected operator. All parameters must be defined before you run the operator. As a shortcut, press <b>CTRL-R</b> .
	<b>Stop Operator</b> - Click this button, if it is red, to stop any on-going process.
	<b>Advanced Parameters</b> - Display advanced parameters for the selected operator. This button is grayed if there are no advanced parameters for the selected operator.
	<b>Add to History</b> - Add the operator call to the History page without executing the operator.

The panel in the middle of the toolbar displays the progress of the operator



## Selecting an Operator

From the Operator dialog box, you can select an operator in the following ways:



Select an operator from a list of the entire Aphelion Operator Library, organized by category.



Select an operator from an alphabetical list of all operators.



Create a list of operators that you use frequently, and select an operator from that list.

### Selecting an Operator from the Aphelion Library

1. In the Operator dialog box, click the Select Operator button. Aphelion displays a list of operator groups.
2. Select the group you want and move the mouse to the right. The second level of categories is displayed.
3. Select the sub-group you want and move the mouse to the right.

✓ Arithmetic/Logic	►	✓ Arithmetic	►	ImgAdd
Edge Detection	►	Bit Logic	►	ImgSubtract
Filtering	►	Logic	►	ImgMultiply
Frequency Domain	►	Constants	►	✓ ImgDivide

4. To view Quick Help for an operator, move the cursor over the name of the operator. A one-line description of the operator appears on the left side of the Statusbar at the bottom of the Aphelion screen.
5. Click the operator you want to use. The operator name and parameters, including Input/Output boxes for images, are displayed in the Operator dialog box. If more than one input or output image is required for an operator, multiple boxes are displayed.

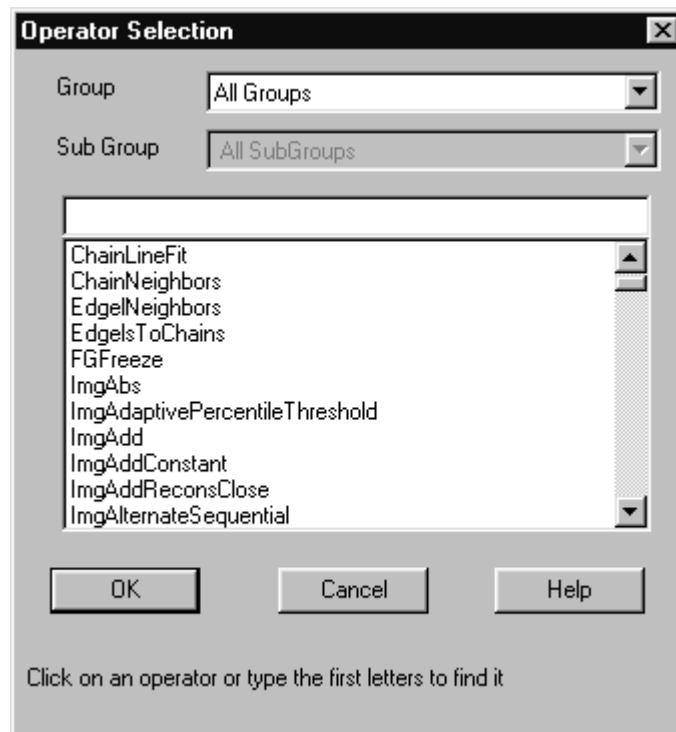
---

**Note:** After you select an operator, Aphelion displays check marks next to the selected group, sub-group, and operator name.

---

### **Selecting an Operator from an Alphabetical List**

1. In the Operator dialog box, click the **A..Z** button. The Operator Selection dialog box appears:



2. Locate the operator you want to select.
  - In the blank field, type the first letter or letters of the operator. Do not type the prefix "Aph". The list of operators automatically refreshes as you type.
  - If necessary, use the scroll bars to scroll through the list of operators.
3. Click **OK** or press **Enter** to select the operator you want.

---

**Note:** To locate an operator by a specific group, click the drop-down list next to the Group field and select the group. To further narrow the list, select a Sub Group from the drop-down list next to that field.

---

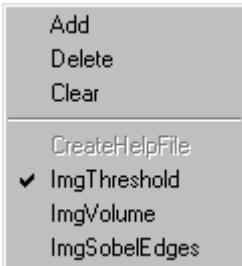
## ***List of Frequently Used Operators***

### **To create a customized list of frequently used operators**

1. From the Operator dialog box, select an operator in one of the following ways:

-  Select an operator from a list of the entire Aphelion Operator Library, organized by category.
-  Select an operator from an alphabetical list of all operators.

2.  Click the Frequently Used Operators button.



3. Click **Add** to add the currently selected operator to the list.

### **To select an operator from a list of frequently used operators**

1.  In the Operator dialog box, click the Frequently Used Operators button.
2. Click to select the operator you want to use.

## **MMX Operators**

 Aphelion 2.3 supports the MMX chip from Intel. This chip dramatically improves the speed of Aphelion operators. If an operator can run on the MMX, a flag icon appears in the right corner of the Operator dialog box. You can run the operator in the MMX or in the general purpose processor of the PC.

---

**Note:** To use MMX acceleration, an optional extension has to be installed during Aphelion setup. Please see the "Release Notes" for more information on the MMX installation.

---

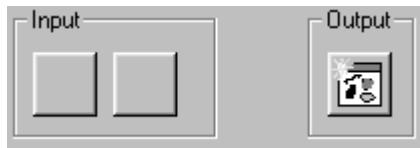
The following operators are currently implemented on the MMX:

- AphImgAdd
- AphImgSubtract
- AphImgMaximum
- AphImgMinimum
- AphImgMultiply
- AphImgThreshold
- AphImgDilate
- AphImgErode
- AphImgConvolve

- AphImgOpen
- AphImgClose
- AphImgWhiteTophat
- AphImgBlackTophat

## Selecting Input and Output Images

If you select an operator that requires input or output images, Aphelion displays input and output boxes in the Operator dialog box. If multiple input or output images are required, multiple boxes are displayed. You must specify an image for each box.




---

**Note:** To improve processing time for large images, you can turn off the display of input and output images as thumbnails. From the **Options** menu, choose **Preferences**. In the Preferences dialog box, deselect **Display image thumbnails**, then click **OK**.

---

Based on the input and output images you select, Aphelion supplies default values for the other parameters.

### Selecting an Input ImageX

1. In the Operator dialog box, click the input image box. A list of open images appears. Based on the task to be performed, only the relevant input images appear in the list.



2. Click the image you want to use for the input image.
3. After you select an image, the input box displays an image pattern similar to the actual image. If you turn off **Display image thumbnails** in the Preferences dialog box, a generic image icon is displayed.

---

**Note:** You can use drag-and-drop to select the image you want. From the Aphelion workspace, drag the image to the input icon.

---

### Selecting an Output Image

Aphelion automatically specifies the output image name. You can change that default using the New w/Options command on the output image menu. See Modifying an Output Image.

1. In the Operator dialog box, click the Output icon. The output image menu appears. It lists open images, and displays a check mark next to New Image by default.



2. Use the default **New Image** or select an image from the list of existing images.
  - If you select **New Image**, the new image icon appears as the output icon. You can modify the image data type, size, or name of the image.
  - If you select an existing image, the output icon displays an image pattern similar to the actual image.

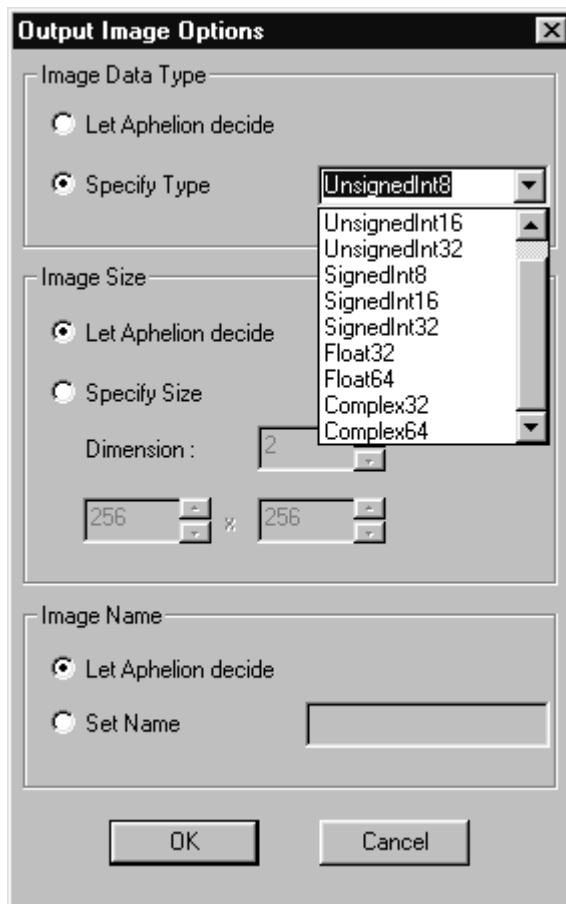
---

**Note:** You can use drag-and-drop to select the image you want. From the Aphelion workspace, drag the image to the input icon.

---

### ***Modifying an Output Image***

1. In the Operator dialog box, click the Output icon. Make sure that **New Image** is selected.
2. Click **New w/ Options...** to display the Output Image Options dialog box.



3. For each of the following categories, you can modify the values or “Let Aphelion decide” the appropriate value.
  - **Image Data Type.** Click the **Specify Type** radio button, then click the drop-down arrow and select a data type from the list.
  - **Image Size.** Click the **Specify Size** radio button, and indicate the number of dimensions (2 or 3) and make any necessary changes to the image size.
  - **Image Name.** Click the **Set Name** radio button and type the name you want to use for the output image.
4. Click **OK**.

### ***Changing the Default Name of the Output Image***

You can change the default name of the New Image output from “Image” to another name.

1. Using WordPad or any other text editor, open the file **StdMessages.txt** in the appropriate language directory under Aphelion/Language.
2. Search for the string “newImNameS=Image %1” .
3. Change the word Image to the default name you prefer.

## **Selecting Operator Parameters**

After you select an operator, the Operator dialog box displays drop-down lists and sliders for selecting image and parameter values. Aphelion supplies default values for many parameters; for others, you must supply the values. For information about setting parameters for specific operators, see the *Aphelion Reference Guide*.

---

**Note:** You must specify all parameters before you can run an operator.

---

{bml op_Parms.bmp}	{bml op_Parms2.bmp}
Parameters for AphImgMorphGradientEdges	Parameters for AphImgThreshold

## **Kernel Editor**

The kernel editor is used to modify a kernel or a structuring element (SE). You can define a kernel or structuring element, name it, enter its name in a list, and save it. Kernels and structuring elements are saved with the project file.<sup>K</sup>

- For convolution, you can modify the value for each element of the kernel.
- For morphological operators, you can modify the structuring element (SE). In this case, only the value X can be entered on each point of the structuring element.

### ***Editing a kernel or structuring element***

The Kernel Editor button is displayed in the Operator dialog box if the operator you have selected uses a kernel or structuring element.

1.  In the Operator dialog box, click the Kernel Editor button to open the Structuring Element editor dialog box.

---

<sup>K</sup> structuring elements

2. Define the size of the kernel or structuring element (SE). There is no limit on the size. To change the size, type values in the X and Y fields under Size. Click Update/Reset.
3. Define the origin of the kernel or structuring element. The origin defines which output pixel is set relative to the position of the kernel. Changes to the origin have the following effects:
  - Reducing the x position of the origin moves the output pixel values to the left.
  - Reducing the y position moves the output pixels up.
 To change the origin of a kernel or structuring element, type values in the X and Y fields under Origin. The origin can be placed anywhere inside the kernel.
3. Enter values.
  - For a convolution, click in each box, and enter values (integer or floating point).
  - For a structuring element, click in each box until you get the adequate value.
4. After defining a kernel or SE, you can type a name in the **Kernel Name** field. Click the **Add** button to add the kernel or SE to a list.
 

If the kernel or SE already exists in the list, just pull-down the list and select it.
5. After defining a kernel or SE, click **OK**. The name of the kernel appears in the Operator dialog box.

## Neighborhood LUTs

Thinning and thickening operations in Aphelion are performed using a lookup table (LUT). A structuring element generates a family of LUTs with entries ranging from 0 to 511. Depending on the configuration of the structuring element, and the type of operation, the output of the LUT is 0 or 1.

By default, Aphelion supplies two predefined LUTs for the Neighborhood Lut Editor:

- L-Skeleton-8C
- L-Skeleton-4C

These LUTs correspond to the L configurations for the structuring elements associated to the skeleton, in 4 and 8 connectivity. You can use the system-supplied LUTs by selecting one from the drop-down list, or create additional LUTs by clicking on the  button. Any defined structuring element and its associated LUT is saved in the current project, with the name you supply.

When you create a new Neighborhood LUT, you can define the exact configuration of the structuring element.

### ***System-Defined Neighborhood LUTs***

Following is a list of the system-defined neighborhood LUTs. These LUTs may not all be available for some operators..

- End Points 8-c
- End Points 4-c
- Multiple Points 8-c
- Multiple Points 4-c

- Single Points 8-c
- Single Points 4-c
- Boundary 8-c
- Boundary 4-c
- Centroid 8-c
- Centroid 4-c
- Pruning 8-c
- Pruning 4-c
- Pruning 8-c(Homotopic)
- Pruning 4-c(Homotopic)
- L-Skeleton-8C
- L-Skeleton-4C
- SKIZ 8-c (Skeleton by Zone of Inference)
- SKIZ 4-c

### ***Selecting a Neighborhood LUT***

1. Select an operator that uses a Neighborhood LUT, such as ImgThin or ImgThicken.
2. In the Operator dialog box, select the input image. The input image must be a binary or gray scale image.
3. In the Type field, click the drop-down arrow and select a Neighborhood LUT from the list. Make sure you have first selected an input image.

### ***Creating a Neighborhood LUT***

1. Select an operator that uses a Neighborhood LUT.
  - ImgThin
  - ImgThicken
  - ImgHitOrMiss
  - ImgConstrainedThin
  - ImgConstrainedThicken
  - ImgThinSkeleton
  - ImgThickenSkeleton
2. In the Operator dialog box, select the input image. The input image must be a binary or gray scale image.
3. Click the  button to open the Neighborhood LUT Editor dialog box.
4. In the Neighborhood LUT Editor dialog box, enter a name for the Neighborhood LUT in the Name field.
5. In the upper left side of the dialog box, enter the values for the structuring element. Click to toggle between 0, 1, or X.

6. When you have finished entering the values for the SE, click the right arrow button  . The values are listed in the box on the right. (To edit an existing Neighborhood LUT, click on the LUT in the box on the right, then make any changes to the SE configuration on the left.)
7. Enter additional SEs if necessary. The morphological operations will alternate between the SEs.
8. Indicate whether the SE will be rotated.
  - no rotation
  - 4 rotations (90 degree rotation after each iteration)
  - 8 rotations (45 degree rotation after each iteration)
9. In the Operations allowed section, indicate what operations will be allowed.
  - Thinning (central pixel of the SE will be set to 0)
  - Thickening (central pixel of the SE will be set to 1)
  - Skeleton (thinning or thickening till idempotence)
  - Hit or miss (if the configuration is found, the central pixel is then set to 1; otherwise, it is set to 0).
10. If you want to use In Place substitution, check that box at the bottom of the dialog box. This option allows you to define whether the operation is performed as a recursive operation (if the box is checked) or not (the box is not checked). A recursive operation is one in which the modified pixel is immediately used for the next pixel in the neighborhood.
11. Click **OK** to create the neighborhood LUT. The Neighborhood LUT is saved with the current project.

### ***Modifying a Neighborhood LUT***

#### **To delete an SE Configuration Neighborhood LUT**

1. Select the name of the Neighborhood LUT from the drop-down list.
2. Click the  button.

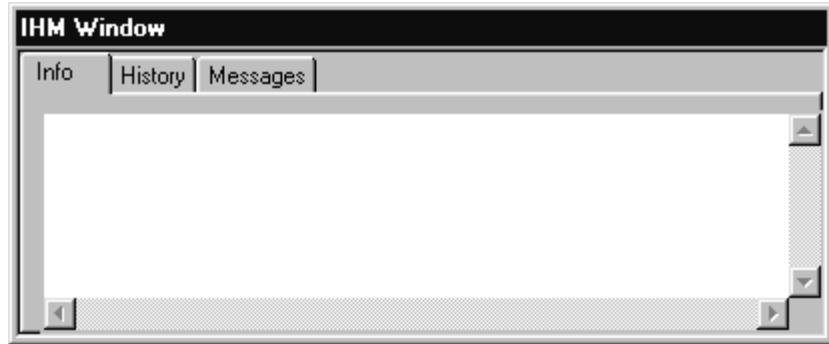
#### **To delete an SE in the Neighborhood LUT Editor dialog box**

1. Select the SE in the list box on the right side of the dialog box.
2. Click the  button.

---

## **Info/History/Messages (IHM) Window**

When you first start Aphelion, the IHM window is displayed in the lower right-hand corner of the interface.



The tabs in the Info/History/Messages window let you access the following information:

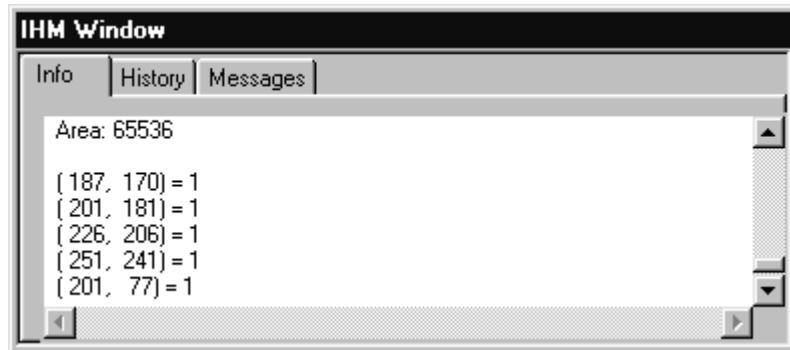
- The Information (Info) tab displays pixel values, output of measurements, and other statistics.
- The History tab displays a list of executed operators and their parameters.
- The Messages tab displays information about non-critical error messages.

---

**Tip:** To display or hide the IHM window, click on the Objects toolbar.

---

## Information (Info) Page



The Info page can display the following information:

- Pixel coordinates and pixel values
- Location of mouse cursor
- Histogram values
- ROI coordinates
- Global measurements
- Other information generated by an Aphelion operator

---

**Note:** Information displayed in the Info page can be saved to a file. To save the information to a file, click the right mouse button in the Info page and choose **Save** or **Save As**.

---

Use the **View** menu on the Aphelion menu bar to indicate what information is displayed in the Info page.

## ***Displaying information in the Info page in the IHM window***

When you display information in the Info page in the IHM window, you can then save that information, or copy it to a macro or other document.

1. From the **View** menu, choose **Info Window Output**.



2. Choose the type of information you want to display.
  - **All Information** - Display pixel coordinates, chart coordinates, overlay information, and measurements from global analysis operators
  - **Pixel Values** - Display pixel coordinates only
  - **Histogram/Profile Values** - Display chart information (from a profile line or histogram)
  - **Overlay Coordinates** - Display overlay information, such as the pixel coordinates of an ROI

## ***Saving information to a file from the Info page***

Information displayed in the Info page of the IHM window can be saved to a file.

1. From the **View** menu, choose **Info Window Output**.
2. Choose what type of information you want to display in the Info page.
3. Run or execute Aphelion processes, display histograms, or compute other information. The values from the operations are displayed in the Info page.
4. Click the right mouse button in the Info page to display the pop-up menu.
5. Choose **Save** or **Save As**.

## **History Page**

The History page displays a batch file of activities. When an operator is executed, a line appears in the History page describing the type of operator used, the names of the input and output images, and the parameters or arguments of the operator.

You can specify whether you want to save the history for the current Aphelion session, or for the current project. Use the **Options→Preferences** command from the menu bar to display the Preferences dialog box and make one of the following specifications:

- To save history for the current project, select **Save Command History in the project**.
- To display history only for the current Aphelion session, make sure that **Save Command History in the project** is not selected.

## **Running One Line of Code**

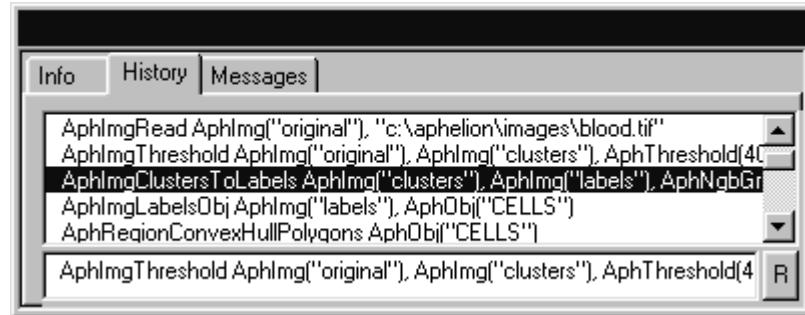
You can use the editing bar at the bottom of the History page to edit and execute a line of code. Click the line you want to run. The line appears in the editing bar.

- To edit the code, click within the line and type. You can use keyboard editing shortcuts such as **CTRL+C** for copy and **CTRL+P** for paste.

- To run the code, click the **R** button at the right end of the editing bar.

### Running Multiple Lines of Code

You can also highlight and run multiple lines of code from the History page. Click to highlight the lines you want to run, then click the right mouse button to display the pop-up menu. Choose **Execute** to run the selected lines of code.



### Copying Lines of Code to a Macro

Selected lines can be copied from the History page and pasted into a macro window. Highlight the lines you want to copy, then click the right mouse button and choose **Copy** or **Cut**.

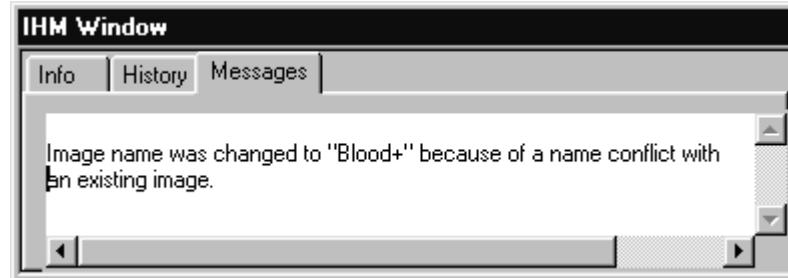
---

**Note:** To display a pop-up menu for loading, saving, and modifying information, right-click anywhere in the History page.

---

## Messages Page

The Messages page displays error messages that are not critical to continuing your work in Aphelion. Critical error messages are displayed in a Error Message windows.




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## Virtual Screens



Aphelion supports multiple screens, called virtual screens. This feature allows you to display multiple Aphelion objects in the same environment. Each tab at the bottom of the screen represents a virtual screen. You can bring a virtual screen to the top by clicking on its tab.

You can display the following objects in virtual screens:

- Images

- ObjectSets
- Grid Documents
- OLE Objects
- Macros
- Text
- Charts

---

**Note:** To open up more space for displaying images and other objects, you can hide the Operator dialog box and the Info/History/Messages window.

- To hide the Operator dialog box, click  on the Main toolbar.
- To hide the IHM window, click  on the Main toolbar.

To display them, click the buttons again.

---

## Adding and Deleting Virtual Screens

When you first start Aphelion, there is only one virtual screen and virtual screen tab, labeled Screen 1. You can create additional virtual screens.

### To add a virtual screen

1. In the Virtual Screen tab area at the bottom of the Aphelion window, click the right mouse button.
2. Choose **Add**. A new tab, representing a new virtual screen, is added at the end of the row of tabs.

---

**Note:** When you exit Aphelion, the names of virtual screens, but not the content, are saved in the configuration file.

---

### To delete a virtual screen

1. Position the cursor on the tab for the virtual screen you want to delete.
2. Right-click to display the pop-up menu.
3. Choose **Delete**.

### To insert a virtual screen

1. Position the cursor on the tab to the left of where you want to insert a tab for a new virtual screen.
2. Right-click to display the pop-up menu.
3. Choose **Insert**.

## Virtual Screen Filer

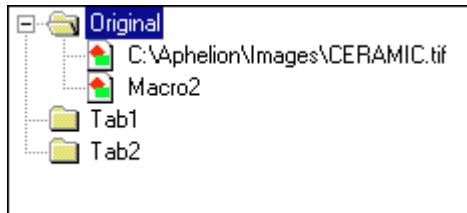


Use the Virtual Screen Filer to:

- Display a diagram of the contents of all virtual screens
- Rename any of the virtual screen tabs

- Rearrange images or other objects within a virtual screen
- Drag images to the Operator dialog box

The example shown below has three virtual screens named: Original, Tab1, Tab2. The virtual window named Original contains two objects, an image and a macro window.



To display or hide the Virtual Screen Filer, click the Virtual Screen Filer button.

The Virtual Screen Filer supports drag-and-drop editing. You can move objects from one virtual screen to another, and you can move objects from the Virtual Screen Filer to other areas of the interface, such as the input and output images in the Operator dialog box.

---

**Note:** To display a pop-up menu of Virtual Screen Filer options, click the right mouse button anywhere in the Virtual Screen Filer area.

---

#### To rename a virtual screen tab

1. On the Objects toolbar, click the Virtual Screen Filer button.
2. Highlight the tab that you want to rename.
3. Click again on the tab until you see the blinking cursor.
4. Type the new name for the virtual screen tab.
5. Press **Tab**.

---

## Aphelion Projects

An Aphelion project stores images, image settings, and other information such as virtual screen names. You can use an Aphelion project file to save information and settings specific to a particular task you are working on. For example, in one project you can save everything you've done on a quality control application and in a second project you can save your work for a presentation.

The name of the current project file is displayed in the Aphelion title bar. A project file always has the extension **.ap**.

- When you start Aphelion, it opens with an empty project by default.
- If you want to automatically reload the last project each time you start Aphelion, use the **Options→Preferences** command to select the option **Automatically load the last project** in the Preferences dialog box.
- When you exit Aphelion, a message box appears asking if you want to save the current project in a file. Click **Yes** to save the project, **No** to exit without saving changes to the project, or **Cancel** to return to Aphelion without saving the project.

## Creating a Project File

Each time you use Aphelion to start a new project, you should start a new project file. That way, you can easily switch between projects and maintain the information you need for each project.

---

**Note:** When you first start Aphelion, it opens with an empty project unless you have selected **Automatically load the last project** from the **Options→Preferences** command.

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### To start a new project file from an empty project

1. From the **File** menu, choose **Save Project As**. The Open dialog box is displayed.
2. Type a name for the project file in the **File name** field. Project files have the extension **.ap**.
3. Click **Save**. The name of the project (along with the name of the window that is currently active in Aphelion) is displayed in the title bar of the main Aphelion window.

### To start a new project file (when another project file is loaded)

1. From the **Options** menu, choose **Preferences**.
2. Make sure that **Automatically load the last project** is not selected.
3. Exit Aphelion, then restart it. Aphelion opens with an empty project.
4. Create your new project and choose **File→Save Project As** to save it.

## Opening a Project File

Use this procedure to open an existing project file.

1. From the **File** menu, choose **Open Project**.
2. Select the project file that you want to open. Project files have the extension **.ap**.
3. Click **Open**.

## Elements Saved in a Project File

Aphelion stores the following information in the project file:

- **General settings**, such as the pathnames for image, macro, and project directories
- **Images**
- **Image aspect** - (Pixel=Point, Aspect Ratio, or Window size)
- **Display Context** (global and image)
- **Kernels** (user-defined)
- **Structuring Elements** (user-defined)
- **Units** (user-defined)
- **Lookup Tables (LUT)** (global and image)
- **Neighborhood Lookup Tables** (used by thinnings, skeletons, etc.)
- **Virtual Screen** names

- **IHM** window settings, including the **command history**
- **Operator dialog box** settings, including the **List of Frequently Used Operators**
- **Chart model files** - used to create histograms, profiles, surface maps, and scatter plots
- **General information** such as the automatic opening of grids, and the display of image icons

When you open a project by clicking **File→Open Project** from the menu bar, you can reopen the images associated to the project by clicking the Image List button on the Main toolbar, and then clicking on each image name.

---

**Note:** ObjectSets are not saved in a project file.

---

## Images

Most Aphelion operators can be used on a wide variety of image formats, including monochrome or color images, binary, 8-bit, 16-bit, 32-bit and 64-bit images, and integer and float images.

### Image File Formats

Aphelion supports the following image file formats:

- Tagged image file (.tif)
- Bitmap (.bmp)
- JPEG (.jpg)
- KBVision (.im)

To import files in other formats, use the Aphelion operator AphImgImport or a third-party conversion tool. You can also acquire live images using a camera.

### **TIFF files**

Aphelion supports reading and writing of TIFF 6.0 Baseline image files. Multiple page and Tiled TIFF images are not currently supported. Aphelion can read both uncompressed and certain types of compressed TIFF files. The following compression types are supported for read only:

- CCITT Group 3 1-Dimensional Modified Huffman RLE
- CCITT Group 3 Fax encoding
- CCITT Group 4 Fax encoding
- PackBits (Macintosh RLE)

Aphelion writes only uncompressed TIFF files.

In addition, Aphelion supports the following extensions to TIFF 6.0 Baseline:

- Data Sample Format - Aphelion supports reading and writing of signed and floating point image data through the Data Sample Format tags.

- Complex image data - Aphelion supports reading and writing of complex image data (2 samples per pixel: real, imaginary) as indicated by the value 32837 for the Photometric Interpretation tag.

Additional details about Baseline and Extended TIFF 6.0 can be found in the TIFF Revision 6.0 specification from Adobe Systems.

### **BMP files**

Aphelion supports reading and writing of Microsoft Windows Bitmap (BMP) image files, also known as Device Independent Bitmap (DIB) image files. Both uncompressed and RLE compressed BMP files can be read by Aphelion. Aphelion writes only uncompressed BMP files.

Aphelion does not currently support any DIB format extensions.

### **KBV files**

Aphelion can read most images from the KBVision system format (.IM extension). The subset supported for reading is:

- one-band images of unsigned byte
- signed int
- signed short int
- float pixel types

Multi-band images and images in the blocked format are not supported. Aphelion does not support KBV format for writing.

### **JPEG files**

Aphelion 2.3 supports reading and writing of JPEG image files. In general, gray scale and color unsigned byte images are supported.

Aphelion can read any standard compression quality rate and also supports progressive scans. Aphelion writes only non-progressive scans in RGB or gray scale mode with the maximum quality rate.

The compression rate used when saving an image file in the JPEG format can be set through the following registry key:

HKEY\_CURRENT\_USER\Software\ADCIS-AAI\Aphelion\2.3\Aphelion\Settings\JpegRatio

The initial value, 100, corresponds to a compression with the best quality. Minimizing this value will reduce the quality of the saved image and will also produce smaller files.

The following image types are not supported:

- edge and complex images types
- and 64 bit pixel types
- CMYK format

Aphelion does not currently support writing of complex, float, or signed image data to JPEG files.

### **Multi-band images**

Aphelion images support an arbitrary number of bands. Some typical uses are for:

- color images (3 bands)
- edge images (2 or 4 bands)

When you display a multi-band image, you can choose to display all bands, the first band, the second band, or the third band. Click the right mouse button to display the Image pop-up menu, then choose the **View** command.

For working with multi-band images, see the following operators:

- AphImgSplitBands
- AphImgJoinBands
- AphImgRGBToColor
- AphImgColorToRGB

## **Opening Images**

There are several ways to open images in Aphelion, including importing and acquiring.

### ***Opening an Image***

Aphelion supports the following image file formats:

- Tagged image file (.tif)
- Bitmap (.bmp)
- JPEG (.jpg)
- KBVision (.im)

#### **To open an image**

1. From the **File** menu, choose **Open Image**. The Open dialog box appears, listing all .tif images available in the Aphelion\Images directory.
  - To change the type of file listed, click the drop-down arrow in the Files of type field.
  - To change the directory, use the standard Windows features.
2. Select the image you want to open.
3. Click **Open**. The image opens in an Image window. The Image toolbar is displayed along the right side of the screen.

After you open an image, you can modify it in various ways. With the cursor positioned anywhere over the image to be modified, right-click to display the Image pop-up menu.

### ***Saving an Image***

After you make any changes to an image, you must save the image or the changes will be lost when you exit Aphelion.

---

**Note:** For .tif files, graphic overlays and rectangular ROIs are saved with the image. ObjectSet overlays are not saved with the image.

---



#### **To save an Image**

1. Make sure the image window you want to save is active. To make an image window active, click on its title bar.
2. From the **File** menu, choose **Save As Image**. The Save As dialog box opens, listing all .tif images available in the Aphelion\Images directory. You can change the directory as needed.
3. From the list of images, choose the one you want to save. (Or type the name of the file in the File name field.)
4. Click the **Save** button. Aphelion displays a message box asking if you want to replace the existing file of the same name. Click **Yes** to write over the existing file or **No** to cancel.

## ***Importing Images***

If you have images in a format other than the supported formats (TIFF, BMP, JPG, KBV), you can import the images into Aphelion using the AphImgImport operator or a third-party conversion application.

AphImgImport allows you to read an uncompressed binary file into an Aphelion image. For example, a SUN raster file can easily be imported into Aphelion using AphImgImport.

### **To use the AphImgImport operator**

1. Determine the image size, pixel type, and file characteristics of the image you want to import.
2.  In the Operator dialog box, click the SelectOper button.
3. Choose **ImageUtilities→Input/Output→ImgImport**.

**Note:** You must define the size and type of the output image. In the Operator dialog box, click the Output image icon, then choose **New w/ Options**.

### **Determining Image Parameters**

To run AphImgImport, you must know the size, pixel type, and file characteristics of the image. If you do not know these values, you can compute the values or use trial-and-error to determine them.

- To compute the parameter values, use the information you have, such as the X and Y dimensions, to determine the other parameters. This can be done by subtracting the product of the X and Y dimensions from the file size. If the remaining number of bytes is fairly small, less than 2000, then those bytes are most likely a file header that can be skipped by setting the File Header Size parameter. If the resulting value is large you may have a multi-byte pixel type (2 and 4 byte ints are common), or a color image. For a color image you will need to run AphImgImport once for each color band, increasing the File Header Size to skip over one or more bands on each subsequent run.
- If you have no information about the size and/or type of the image file, you can determine the information through trial and error. You do this by repeatedly running the AphImgImport operator with different argument values and viewing the resulting image on the screen. By varying the X and Y dimensions and pixel type of the output image, you can obtain a recognizable image on the screen. You then determine the File Header Size by closely examining the first pixels in the image and removing any that do not look like pixel data.

### **To use a conversion program**

Several image conversion applications are widely available. To use one of these applications, first load the image, and then save it as a TIFF or BMP image.

Image Conversion Application	Company
Graphics Workshop	Alchemy Mindworks, Inc.
HiJaak	Quarterdeck Corp.
Image Alchemy	Handmade Software, Inc.
LView Pro	Leonardo H. Loureiro
Paint Shop Pro	JASC, Inc.

## **Acquisition Boards**

Aphelion has built-in support for several digitizer boards. If you have one of the boards listed below, you can capture live video at full-motion rate:

- Imaging Technology, Inc. (ITI) - IC-PCI module (AM-VS, AM-DIG, AM-FA, AM-CLR, STD-COMP, STD-RGB)
- MuTech, Inc. - MV-1000 (monochrome), MV-1300 (color), IV-450
- Data Translation, Inc. - DT 3155 (monochrome)
- Matrox Meteor, Matrox Meteor II, Matrox Meteor/RGB, Matrox Meteor/PPB
- Matrox Pulsar and Corona for non-standard acquisition
- Integral Technologies - FlashPoint 128 (monochrome and color)

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**Note:** A Twain driver is also available in Aphelion to acquire images from a scanner, or from any external device which supports the Twain format.

---

You can use the optional Porting Kit module to interface other acquisition boards with Aphelion.

## **Acquiring a Live Image**

To acquire a live image, you first must have the necessary acquisition boards and cameras installed.

1.  On the Objects toolbar, click the **Camera** button.
2. Select the logical camera you want to use.
3.  In the Operator dialog box, click the **Select Operator** button.
4. Click **Image Acquisition→Grab/Snap→ImgGrab** or **ImgSnap**.
5. In the Operator dialog box, click the **Acq board** drop-down list to select the acquisition board you want to use.
6.  Run the operator. The image appears in an image window.
7. Use the Acquisition Toolbar buttons, along the right side of the screen, to grab, freeze, or snap the image, or to adjust it. See Acquisition Toolbar for more information.

## Closing and Freeing Images

- Closing an image. When you close an image, the image window closes but the image file is kept in memory. This allows you to clear the workspace, but still have ready access to the image file.
- Freeing an image. When you free an image, you close it and remove it from memory. This frees up system resources. After you free an image, you must reload the image in order to work with it.

### ***Closing an Image***

When you close an image, the window closes but the image file is kept in memory. This allows you to clear the workspace, and redisplay the image as needed.

---

**Note:** You can also minimize an image window to clear up display space. To minimize a window, click the Minimize button in the upper right corner of the image window. (Or press Alt-Spacebar-N.)

---

#### **To close an image**

- From the menu bar, choose **File→Close**. As a shortcut, click the **X** button in the upper right corner of the image window or press **CTRL+F4**.

#### **To close all image windows**

- From the menu bar, choose **Window→Close→Images**.

#### **To redisplay a closed image**

1.  Click the Image List button.
2. From the list of images, select the one you want to redisplay.

### ***Freeing an Image***

If you are done working with an image and want to close it and remove it from memory, you can free the image. This frees up memory in the system, and may be especially useful when working with large images. If you free an image, you have to reload it in order to work with it.

---

**Warning:** If you have not saved the images you are freeing, such as an output image created by running an Aphelion operator, you cannot restore the images after freeing them.

---

#### **To free an image**

1. From the Operator dialog box, select **Image Utilities→Generation→ImgFree**.
2. Click the Input icon to display a pop-up list of all images that have been accessed during the current Aphelion session.
3. Select the image you want to free.
4.  Run the operator. Aphelion frees the image from memory.

#### **To free the currently active image**

1. With the cursor positioned over the image, click the right mouse button to display the Image pop-up menu.
2. Choose **Free this image**.

### To free all images

1.  From the Operator dialog box, click the Free All Images button.
2. Aphelion displays the message "Free all images?" Click Yes to free all images. Click No to cancel and return to the Aphelion screen.

### To reload an image

1. From the menu bar, click **File**.
2. Select the image you want to reopen from the numbered list of files at the bottom of the menu. If the file is not listed, open the image using the usual procedure. See Opening an Image.

## Image Views

When you open an image, it is displayed in an image window. The image view can be set to:

- **Pixel=Point**. Indicates that the window cannot be resized beyond the pixel size of its x and y axis. If the size of the window is smaller than the size of the image, use the scroll bars to pan the image.
- **Aspect Ratio**. Maintains the aspect ratio of the image.
- **Window Size**. Allows each axis of the window to be resized independently.

By default, images are opened with the image view set to **Aspect Ratio**.

To modify the view for a particular image, open the image and click the right mouse button to display the Image pop-up menu. Choose **View**.

To modify the default view for all images opened in Aphelion, choose **Options→Preferences** from the Aphelion menu bar.

### Resizing an Image

To resize an image, you may need to change the pixel aspect for the image. You can do this for an individual image by using the **View** command from the Image pop-up menu.

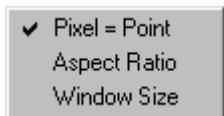
---

**Note:** To set the default pixel aspect, use the **Options→Preferences** command on the Aphelion menu bar. See Modifying the Default Image View.

---

### To resize an image

1. With the cursor positioned in the image window, click the right mouse button to display the pop-up menu.
2. Choose **View** to display a pop-up menu.



3. Choose one of the following options:
  - To indicate that the window cannot be resized beyond the pixel size of its x and y axis, choose **Pixel=Point**. If the size of the window is smaller than the size of the image, use the scroll bars to pan the image. Hold down the mouse button and move the scroll bars, then release the mouse button to refresh the image.

- To maintain the aspect ratio of the image, choose **Aspect Ratio**.
  - To allow each axis of the window to be resized independently, choose **Window Size**. The image is resized to fit the window.
4. Use the mouse to resize the image as needed.

## ***Zooming (Image)***

 Click the Zoom button on the Image toolbar to zoom in on a selected part of an image. When you zoom in on an image, the aspect ratio of the image is maintained.

**Note:** You can also zoom in on a chart window. For more information, see Chart Toolbar.

1. Make sure that the image you want to zoom in on is active.
2. Click the Zoom button. The cursor changes to the shape of a magnifying glass.
3. Drag the cursor over the part of the image you want to zoom in on. Release the cursor.
  - To undo the zoom, click the Reset Zoom button or press **CTRL+Z**.
  - To reset the image to its original display, undo the Zoom as many times as needed, or close the image file and reopen it.

## ***Image Properties***

After you open an image, you may need to enhance the display by modifying image properties, such as the lookup table or display context.

### ***Image Properties***

If you need to modify properties for a specific image, including LUT, display context, and image name, data type and size, use the **Properties** command on the Image pop-up menu.

#### **To modify image properties**

1. With the cursor positioned in the image window, right-click to display the Image pop-up menu.
2. Choose **Properties→Properties** to display the Image Properties dialog box for the active image.
3. From the Image Data page, you can make the following modifications:
  - To modify the image class, click the drop-down arrow and select an image class. Changing the image class can be useful when an operator only accepts one type of image class. For instance, ImgJoinBands requires a color input image. If you want to join a gray scale image to a color image you can change the Image Class from AphGreyScale to AphColor.

**Note:** Do not use the Image Class drop down menu to change a grey scale image to a binary image. Use the AphImgThreshold operator instead as this allows you to specify the thresholds to use.

- To modify the data type, click the drop-down arrow and select a data type. Changing the image data type can be useful for reducing the amount of memory used by an image. For instance, if an image uses Int32 pixels, but all the values

are between 0 and 255, you can change the type to UInt8 and reduce the size of the image by a factor of four without losing any data.

- To modify the size of the image, type or click the arrows to specify the new size.
4. Click **Apply**, then click **OK**.

---

**Note:** Click the Display Context and LUT tabs to change those values for the current image window only. To change the Display Context or LUT at the image or global level, use the **Select DC** and **Select LUT** commands from the Image pop-up menu.

---

### ***Calibrating an Image***

Measurements calculated by Aphelion use the calibration values set in the Calibration dialog box. You use the Calibration dialog box to modify the default values and assign units and distance to pixels in an image. You can define the units to be applied to each pixel, including pixel (image points), size (meters or other units), and time (seconds).

#### **To calibrate an image**

1. With the cursor positioned anywhere in the image window, click the right mouse button to display the pop-up menu.
2. Choose **Properties→Calibrate**.
  - The Calibration dialog box opens.
  - A set of rulers is displayed in the image window. (The lines of the rulers are red.)
3. In the top half of the dialog box, specify the unit of measurement such as microns or meters. You can click the drop-down arrow and select a unit, or type a new unit in the field.
4. If you know the calibration factors (per pixel), type those values in the fields for the X and Y axes.

You can also specify a value for either X or Y, and then click **Pixel Aspect** to specify the ratio of X/Y.

5. If you do not know the calibration factors, you can calculate them using the ruler that is overlaid on the image window.
  - Use the mouse to move the rulers displayed over the image. First, click inside the rulers to display the handles on the lines. To move the rulers, drag the mouse inside the rulers. To move only one end, drag the handle at the end of the line. Move the rulers until they represent the desired starting point and length.

To further adjust the length of each ruler, click the (X,Y) button and type the length of each ruler (in pixels). (Click anywhere in the image to refresh the ruler lines.)

- Click **Length**. Type the length of each ruler line (in the unit indicated).
  - From the keyboard, press **Tab** to update the calibration factors.
6. To account for distortion, you can use the **Rotation** field to select an angle between the X and Y axes other than 90 degrees.
  7. Click **OK**.

#### **To save a calibration**

1. Type the name for the calibration in the **Image Calibration** field at the top of the dialog box.
2. Click **Save**. You can then choose this calibration from the **Image Calibration** drop-down list at the top of the dialog box.

---

**Note:** To delete a saved calibration, select the one you want to delete from the drop-down list. Click the delete button  next to the **Image Calibration** field.

---

### ***Adjusting the Contrast/Brightness***

You can adjust image contrast and brightness for:

- The active window
- An image
- All images in the current Aphelion project

---

**Note:** If you want to adjust the contrast/brightness for only the active window, right-click in the image window and choose **Properties→Contrast/Brightness**. Then follow steps 5 and 6 below.

---

#### **To adjust contrast/brightness**

1. With the cursor positioned in the image window, right-click to display the pop-up menu.
2. Choose **Properties→Select DC** to open the Display Context Selection dialog box.
3. Use the Window Display Context, Image Display Context and Global Display Context tabs to indicate which images you are modifying.
  - The **Windows** settings apply to the active window.
  - The **Image** settings apply to the Image and will be saved with the image.
  - The **Global** settings apply to all images in the current Aphelion session.
4. Click the Options button to open the Contrast dialog box.
5. Use the sliders to adjust contrast and brightness. As you move the sliders, you can see the changes reflected in the image and in the value displayed at the bottom of each slider bar. The values for contrast and brightness range from -50 to 50.
6. To save the changes to contrast and brightness, click **OK**. If you want to return to the default values, click **Default**. The default value for both brightness and contrast is 0.
7. Click **OK** again to close the Display Context Selection dialog box.

### ***Selecting the Display Context***

It is often useful to display images without using the standard display range (256 gray level values, and a ramp lookup table). This might be useful when images are digitized on more than 8 bits, such as 16 bit integer or floating point images, or when the range of the image is different from the 0-255 range. For example, after the computation of a Fast Fourier Transform, it is usually necessary to modify the display context to change it to the Logarithmic LUT, and to specify the range of pixels in the neighborhood of the peak.

An output LUT and a display range are associated with a display context.

You can apply the display context to the current window, to the image, or to all image windows displayed in Aphelion.

### To select the display context

1. With the cursor positioned in the image window, right-click to display the pop-up menu.
2. Choose **Properties→Select DC** to open the Display Context Selection dialog box.
3. Use the Window Display Context, Image Display Context and Global Display Context tabs to indicate which parameters are affected.
  - The **Windows** settings apply to the active window.
  - The **Image** settings apply to the Image and will be saved with the image.
  - The **Global** settings apply to all images in the current Aphelion session.
4. Select the LUT.
  - **Use Default:** The display context will use the default LUT associated with the image.
  - **Linear LUT:** A ramp from a low value to a high value.
  - **Absolute value:** In case of negative images, all negative values are turned into their positive values. For positive images, this LUT has no effect.
  - **Logarithmic LUT:** The output LUT is a logarithm. This is especially used in the case of FFT computation.
  - **Label LUT:** This is the binary LUT, and it is used after labeling of a binary image.
5. After selecting a LUT, you can specify the input range of the LUT entries. Output LUT range is always be adapted to the screen, and will usually be between 0 and 128. You can use the default settings and configuration, or specify the range manually.
6. To specify the range manually, click in the **Override default settings** box. Select one of the following options:
  - **Datatype min/max:** The range is between the minimum and the maximum associated to the type of the image. For example, in the case of 16 bit unsigned integer images, the range will go from the value 0 to value 65535.
  - **Image min/max:** The range is between the minimum and the maximum pixel gray level values. This is usually the most appropriate selection. However, these values are computed every time a new image is refreshed.
  - **Estimated min/max:** In the case of large images, computing the minimum and maximum values can take a while. It then can be interesting to estimate these values by only scanning a subset of the image. The percentage associated to this selection allows you to specify the number of pixels randomly scanned to estimate those two values.
  - **Manual min/max:** It is sometimes useful to specify manually the minimum and maximal values, such as in the case of a power spectrum display after an FFT computation. You can type any value in these two fields, even if they are out of the image range.
7. Click **Apply** to apply the value. Click **OK** to apply the values and close the dialog box.

## **Selecting a Lookup Table**

The lookup table defines the mapping from image values to display colors. You can use an existing LUT, or use the LUT editor to create new LUTs and add them to the existing list.

### **To select a LUT**

1. With the cursor positioned in the image window, right-click to display the Image pop-up menu.
2. Choose **Properties→Select LUT** to open the Look Up Table Selection dialog box.
3. Use the Window LUT, Image LUT and Global LUT tabs to indicate which parameters are affected.
  - The **Window** settings apply only to the active image window.
  - The **Image** settings apply to the Image and will be saved with the image.
  - The **Global** settings apply to all images in the current Aphelion session.
4. To use an existing LUT, select it in the list on the left side of the dialog box.
5. Click **Apply** to apply the lookup table.
6. Click **OK**.

---

**Note:** For a global LUT, you can also select an image class. All images in the chosen class will default to the defined LUT.

---

## **Defining a New LUT**

You can define a new LUT, which can then be saved with the current project.

1. From the Lookup Table Selection dialog box, click the **New LUT** button. The LUT Editor dialog box appears.
2. Add, delete, or move the control points.
  - To add a control point, move the mouse, click the right mouse button, and choose **Add Point→All**. You can add multiple control points on the curve.
  - To delete a control point, click the right mouse button and choose **Remove Point**.
  - To move a control point, drag the point using the mouse.
  - To specify the exact location of a point, click the right mouse button and choose **Show Point**. To help define points, click the Zoom button to zoom in on the curve.
3. After you define the LUT, type a name for the new LUT in the **Lut Name** field.
4. Click **Set** to save the new LUT.
5. Click **OK** to return to the Lookup Table Selection dialog box. The new LUT now appears in the list of available LUTs. You can then select this new LUT.
6. Click **Apply** to apply the lookup table.
7. Click **OK** to close the dialog box.

---

**Note:** To add or change properties of the new LUT, click the right mouse button and choose **Properties**. You can add a title, change background and foreground colors, and modify various other properties.

---

# Grid Documents

Grid documents are used to display object measurements in a spreadsheet format. For example, a grid document may be used to display ObjectSet data for analysis and charting.

REGIONS					
	PIXEL_COUNT	REGIONEXTI_LL.X	REGIONEXTI_LL.Y	REGIONEXTI_UR.X	REGIONEXTI_UR.Y
1	2	31	0	31	31
2	2	42	0	42	42
3	255	91	0	110	110
4	3	202	3	202	202

## Displaying an Object Grid Document

You can specify whether you want a grid to open automatically each time an ObjectSet is computed, or open a grid from the interface.

### To open a grid automatically

1. From the Options menu, choose **Preferences**.
2. Make sure that the **Automatically display grid** option is checked.

### To open a grid from the Main toolbar

1.  On the Objects toolbar, click the Object grid button.
2. Select an ObjectSet from the drop-down list.

### To open a grid from the menu bar

1. From the **File** menu, choose **New**. The New dialog box opens.
2. Choose **Grid Document** and click **OK** to display a blank Grid document window.
3. With the cursor positioned in the Grid document, click the right mouse button.
4. Choose **Load** and slide the mouse to the right. Select the file to be loaded.

## ISR Histograms

You can draw a histogram of selected data from a grid.

1. Display a grid.
2. Select the column in the grid that represents the data set (ObjectSet attribute) of interest.
3. Click the right mouse button to display the Grid pop-up menu.
4. Choose **Histogram**. Aphelion displays a chart window containing the histogram. The title bar of the chart window displays the name of the grid and the ObjectSet attribute that the histogram is based on.

**Note:** You can use message passing to select a range on a histogram and highlight the corresponding objects in the grid. Click the mouse to select one bin, or drag the mouse to select multiple bins on the histogram. As you highlight the histogram, the corresponding objects are highlighted in red on the grid. You can highlight just one range at a time.

---

# OLE Objects

You can use either BasicScript functions or the Aphelion interface to set up OLE communication.

## Using OLE and BasicScript Macros

From a macro, you can start an OLE communication and access the properties and methods of another application. Three BasicScript functions are available to control the OLE communication and to access objects.

- CreateObject
- GetObject
- Object

For more information about these functions, see the Macro Language Reference Guide. Or, in the Index tab of the Help screen, type the name of the function.

To start the communication, you create an object relative to the application you wish to start. For example, to start Excel:

```
Set Excel = CreateObject ("Excel.Application")
```

The function CreateObject creates an OLE Automation object and returns a reference to that object. The Set function assigns a value to an object variable. After initiating an OLE communication and creating the object, you can access the properties and methods of the object using the dot syntax, such as:

```
object.property = value
```

---

**Note:** The properties of an object are described in the on-line documentation for the object. For example, the Excel documentation provides a list of all the properties attached to the application. To view the on-line documentation, locate the file named vba-xl.hlp. Then select the Microsoft Excel Visual Basic Reference entry.

---

Following are some examples of properties attached to Excel.

```
Set WorkBook = Excel.Workbooks Define a Workbook
```

```
WorkBook.Add Add a new book
```

```
Set Sheet = Excel.ActiveSheet Activate a sheet in the book
```

```
Set c = Sheet.Cells Define cells
```

```
Set cell = c.Item(1,1) Define the first cell in the sheet
```

```
cell.value = "Histogram" Output a string in the first cell
```

```
Excel.Quit Exit Excel
```

Every Windows application that supports OLE automation has properties attached to it. You can access those properties from an Aphelion macro or from Visual Basic.

## Example Macros

Aphelion includes two example macros that demonstrate the OLE communication feature.

- ExportToExcel.apm shows how to interact with Microsoft Excel.

- ExportToWord.apm shows how to communicate with Microsoft Word.

## Communicating with ActiveX or COM Components

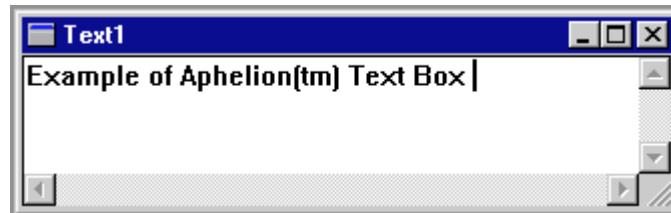
You can communicate with an ActiveX or COM component from an Aphelion BasicScript macro. As with OLE communication, an ActiveX component has properties and methods which can be accessed from a macro. The following example shows how to call a COM component in a macro. This component is a stand-alone program to control the stage of a microscope.

```
Dim sres As string
Dim sarg As string
Dim Ascope As Object
Set Ascope = CreateObject( "AutoScope.AutoScopeCmd" )
sarg = "Move"
sres = Ascope(sarg)
Set Ascope = Nothing
```

In this example, AutoScope is an ActiveX component. You first create the object, and then call that object with parameters.

## Text Files

To explain or clarify information, you can add text files. You can type the text or load an existing text file. The text window can also be used as a log file.




---

**Note:** To display a pop-up menu for loading, saving, and editing text, right-click in the text window.

---

### To add text

1. From the File menu, choose New. The New dialog box opens.
2. Choose **Text Document** and click **OK**. An empty text window opens.
3. Enter text in one of the following ways:
  - Type the text.
  - Click the right mouse button and choose **Load**. Highlight the file you want to load and click **Open**.
4. Edit the text as needed.
  - To cut, copy, and paste text, first select the text you want to work with. The Cut, Copy, and Paste buttons on the Main toolbar are then available.
5. To save the text file, click the right mouse button and choose **Save**.

### To open an existing text file

1. From the **File** menu, choose **New**. The New dialog box opens.

2. Choose **Text Document** and click **OK**. An empty text window opens.
3. Click the right mouse button to display the Text pop-up menu.
4. Choose **Load** to display the Open dialog box.
5. Highlight the file you want. If needed, change directories to find the file. By default, the file type is .txt.
6. Click **Open**. The text file opens in the text window. The pathname of the file is displayed in the title bar of the text window.

---

**Shortcut:** To bring up the Open dialog box for text files, press **CTRL-T**.

---

## Overlays

You can draw overlay objects in Aphelion to annotate images or to extract or manipulate information in an image. Overlays are attached to the image in which they are drawn, and saved with that image.

When you open an image, the Image toolbar is displayed along the right side of the screen. The **Select Objects** tool and **Graphic Overlay** mode buttons are selected by default.



The Image toolbar includes an Overlay button at the bottom of the toolbar. The Overlay button indicates what mode is currently active. To change modes, click the Overlay button and select a different mode from the pop-up list.

Button	Overlay Mode
	Graphic objects
	Regions of interest (ROI)
	Histograms
	Profiles

After you select a mode, you must then activate one of the tool buttons. For example, if you want to select an ROI, make sure the **ROI** mode button and the **Select Objects** tool button are selected.

## Overlay Types and Properties

You can change some properties for each type of overlay, such as the line color for a specific histogram rectangle. See the Help topic for each type of overlay for more information.

Type	Shape	Line Color	Notes
Graphic object 	Point Line Rectangle Rounded rectangle Ellipse	Blue	To delete a graphic object, select the object, then click  or press CTRL+X.

	Polygon Freehand		
ROI 	Rectangle Ellipse Polygon Freehand	Green	Disabled ROIs appear with a dashed green and white outline. To delete all ROIs, use the Delete All command on the pop-up menu.
Histogram 	Rectangle	Purple	
Profile 	Line	Purple	

## Graphic Overlay Objects

You can draw graphic overlays in any image window. Graphic overlay objects include:

- Points
- Lines
- Rectangles
- Rounded rectangles
- Ellipses
- Polygons
- Freehand drawing
- Text

After you draw an object, you can change certain properties, such as the line or fill colors. You can also change the line width and the size of the handles. To change properties, click the right mouse button and select **Graphic** to display the graphics menu.




---

**Note:** Except for line color, property changes apply only to selected objects. If you change the line color, any other graphic overlay objects you draw in that image will be drawn in the new color.

---

## Layered Objects

If you have drawn layered objects, use the following commands to adjust the way the objects are displayed:

- Move to Front
- Move to Back
- Move Back
- Move Forward

The **Move to Front** and **Move to Back** commands move a selected object in front of or behind other objects. The **Move Back** and **Move Forward** commands move a selected object back or forward one level within a group of overlapping objects.

### Drawing a Graphic Overlay Object

To draw a graphic overlay object, be sure that the image you want to work with is active.

---

**Tip:** If you have several images open and want to focus on one of those images, click  on the Objects toolbar. Select the image you want to use.

---

1.  Make sure you are in Overlay mode. To enable Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2. Click one of the toolbar buttons to select the type of object you want to draw:



Point



Line



Rectangle



Rounded Rectangle



Ellipse



Polygon



Freehand



Text

3. After you click the type of object you want to draw, the cursor changes into a cross-hair shape or a pen shape.
  - To draw a point, position the cursor and click once.
  - To draw a line, rectangle, rounded rectangle, or ellipse, drag the mouse. To end the drawing, release the mouse button.
  - To draw a polygon, click at the desired vertices. The cursor changes into the shape of a pencil as you draw. Double-click to end the drawing.
  - To draw a freehand polygon, drag the mouse. Double-click to end the drawing.
  - To draw a contour with the pen, just move the mouse over the image, clicking on the left mouse button to modify the image.
  - To add text, click in the image where you want to place the text. Enter the desired text and formatting options in the Text Object dialog box.

---

**Note:** After you have drawn objects on the image, you can convert those objects (except text) to ROIs. See Converting Graphic Overlay Objects to ROIs.

---

## **Point Overlays**

You can use point overlays to place markers in an image, display the pixel coordinates, and copy those coordinates to a macro.

1. From the **View** menu, choose **Info Window Output→Overlay Coordinates**.
2.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
3.  Click the **Point** button.
4. Click in the image to place the points. For each point, the pixel coordinates are displayed in the Info page of the IHM window. (If the window is not visible, click the Show IHM button on the Objects toolbar.)

---

**Tip:** Use the arrow keys to fine tune the position of the point.

---

5. Copy the coordinates from the Info page to use in a macro.

You can also draw point overlays using the following operators:

- AphImgTrace
- AphImgWarpControlPoint

## **Moving and Resizing a Graphic Overlay Object**

### **To Move a Graphic Overlay Object**

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the object you want to modify. Handles appear along the outline of the object.
4. Point the cursor anywhere within the object. Hold down the mouse button and drag the object to a new location.
5. Release the mouse button.

### **To Resize a Graphic Overlay Object**

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the object you want to modify. Handles appear along the outline of the object.
4. Point the cursor at one of the handles.

- To resize the image and maintain the aspect ratio, point at one of the corner handles.
  - To resize the image by width or height, point at one of the handles along the sides.
5. Hold down the mouse button (the cursor turns into a double-headed arrow) and drag the object until it is the size you want.
  6. Release the mouse button.

### ***Changing the Line Color of a Graphic Overlay Object***

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the object you want to change. To select additional objects, first hold down the **Shift** key.
4. Choose the Line Color option in one of the following ways:
  - On the Image toolbar, click .
  - From the Image pop-up menu, choose **Graphic→Line Color**.
 The Color dialog box appears.
5. Select the color you want and click **OK**. The line color of the selected objects changes to the color you selected.

### ***Changing Line Width and the Size of Handles***

You can change line width or size of handles for a graphic overlay objects for one selected object at a time.

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the object you want to modify.
4. Right-click to display the Image pop-up menu
5. Choose **Graphic→Line Width** to display the Overlay Graphic Properties dialog box.
  - To change the width of the line (in pixels), type a number in the **Width** field. The default is 1.
  - To change the handle size (in pixels), type a number in the **Handle Size** field. The default is 1.
6. Click **OK** to apply the changes to the currently selected graphic overlay only.

## **Changing Fill Color**

The Fill feature is available only for rectangular graphic overlay objects. You can change the fill color for only one selected object at a time.

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the object you want to modify.
4. Right-click to display the Image pop-up menu.
5. Choose **Graphic→Properties** to display the Overlay Graphic Properties dialog box.
6. Click the Fill check box, then click **OK**.
7. Click the right mouse button to display the Image pop-up menu, then select **Graphic→Fill Color**. The Color dialog box appears.
8. Select the color you want and click **OK**. The fill color of the selected object changes to the color you selected.

---

**Note:** You can select the Fill color first, then check the Fill check box in the Overlay Graphic Properties dialog box.

---

## **Copying and Pasting a Graphic Overlay Object**

You can copy and paste an overlay object in an image window, or from one image window to another. You can select and copy multiple drawn objects.

---

**Tip:** To select several objects at once, click , then drag the cursor over the objects you want to select. When you release the mouse button, the objects are selected.

---

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Click to select the object you want to copy. To select multiple objects, hold down the Shift key.
4.  On the Main toolbar, click the **Copy** button.
5.  To paste the copy into the same image, click the **Paste** button on the Main toolbar. Aphelion pastes the copy on top of the original object. Drag the copy to a new position.

To paste the copy into another image, open or focus on that image. Click the **Paste** button on the Main toolbar. The object is pasted into the active image.

## **Deleting Graphic Overlays**

You can cut one or more overlay objects in an image window.

1.  Make sure you are in Graphic Overlay mode. To enable Graphic Overlay mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Click to select the object you want to copy.  
To select multiple objects, hold down the Shift key. Or drag the mouse over the objects you want to select.
4.  On the Main toolbar, click the **Cut** button or press **CTRL+X**.

## **Freehand Drawing**

In Graphic Overlay or ROI mode, you can draw in an image window using the **Pen/Eraser** tool. This tool allows you to modify pixel values in the image, or to mark binary objects to be removed.

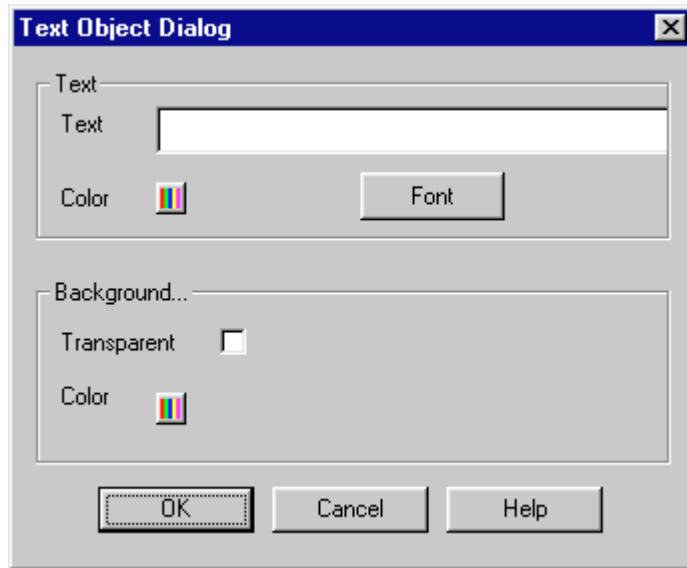
1. Make sure that Graphic Overlay or ROI mode is enabled. Click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic** or **ROI**.
2.  On the Image toolbar, click the **Pen/Eraser** button.
3. Drag the mouse to draw a freehand contour in the image.
4.  On the Image toolbar, click the **Select Objects** button. Click on the contour you just drew to select it.
5. Click the right mouse button to display the pop-up menu.
6. Choose **Graphic→Pen/Eraser**.
7. You can then:
  - Set the contour to value 0
  - Set the contour to 1 or the maximum of the image type
  - Set the contour to the local minimum on the contour
  - Set the contour to the local maximum on the contour
  - Remove binary objects marked by the pen

## **Text Overlays**

In Graphic Overlay mode, you can add text boxes to an image using the **Draw Text** tool. You can position text, set the font, text color, and background color of the text box.

1. Make sure that Graphic Overlay mode is enabled. Click the **Overlay** mode button at the bottom of the Image toolbar and choose **Graphic**.
2.  On the Image toolbar, click the **Draw Text** button. The cursor changes to a crosshair shape when over the image.

- Click in the image where you want to place the text. This brings up the Text Object dialog box.



- Enter the text you want to add into the Text field.
- Select the text and background options you want.
  - To change the color of the text, click the **Color** button in the Text area.
  - To change the font and size of the text, click the **Font** button.
  - To change the background color of the text box, click the **Color** button in the Background area. The default background color is white.
  - To make the text box background transparent, select the Transparent option.
- Click **OK**. Aphelion adjusts the size of the text box to fit the text you entered.

---

**Note:** You cannot change the color of the text overlay from the Font dialog box. You must use the Color button in the Text area of the Text Object dialog box.

---

To reposition the a text box, select it and drag it with the mouse.

### ***Changing a Text Overlay***

You can change the content, font, font size, text color, and background color of a text overlay.

- On the Image toolbar, click the **Select Objects** button.
- Double click the text overlay that you want to modify. This brings up the Text Object dialog box.
- Modify the items you want to change.
  - To change the content, enter new text in the Text field.
  - To change the color of the text, click the **Color** button in the Text area.
  - To change the font and size of the text, click the **Font** button.

-  To change the background color of the text box, click the **Color** button in the Background area. The default background color is white.
  - To make the text box background transparent, select the Transparent option.
4. Click **OK**. Aphelion adjusts the size of the text box to fit the text you entered.

To reposition the a text box, select it and drag it with the mouse.

## Region of Interest (ROI)

Image processing operations are usually performed on an entire image, but in some cases it is useful to restrict the processing to a region of interest (ROI). ROIs let you focus on selected areas of an image. For example, you might use regions of interest to:

- Enhance part of an image
- Provide faster processing
- Produce a count of objects for a selected region

There are several ways to create ROIs:

- Draw ROIs
- Convert the spatial attributes of an ObjectSet to ROIs
- Convert the spatial attributes of graphic objects to ROIs

After you create the ROIs, you then run an operator to perform only on the regions of interest. You can disable ROIs as needed, and later enable them again.

---

**Note:** When you draw an ROI in an image, the ROI is outlined in green. In the current release of Aphelion, you cannot change the default color.

---

### Macro Example

To view an example of analyzing ROIs in an image, run the **RoiProcess.apm** macro that comes with Aphelion.

1.  Click the **Macros** button on the Objects toolbar.
2. Choose **Macros→RoiProcess.apm**.
3.  In the macro window, click the **Run Macro** button.

### BasicScript and C++

Using BasicScript, you can use commands like AphImgAddRoi and AphImgRemoveRoi to define and remove ROIs. (In BasicScript, you can define only rectangular ROIs.)

You can define and access ROIs in BasicScript using the following commands.

- AphImgEnableROI
- AphImgRoiCount
- AphImgRoi
- AphImgAddRoi
- AphImgRemoveRoi

- AphImgResetRoi
- AphImgMoveRoi
- AphImgResizeRoi

Using C++, ROIs are implemented as a list of instances of classes derived from the abstract AphRegion class (AphROI is a synonym of AphRegionSet). For more information, see the *Aphelion Developer Guide*.

---

**Note:** Every image has an ROI, numbered 0, that covers the entire image. In the interface, this ROI is not displayed, and cannot be enabled, disabled, or deleted. When you draw an ROI in an image window, the original ROI is automatically disabled. When you remove or disable all drawn ROIs, the original ROI is enabled again.

If you are writing a macro using BasicScript commands, you must disable the original ROI in order to process ROIs that you have created. See AphImgAddRoi for further information and examples.

---

## ***ROI Features***

Aphelion provides the following flexible features for ROI processing:

- You can draw an ROI as a rectangle, polygon, ellipse, or freehand contour.
- You can convert ObjectSets to ROIs.
- You can convert graphic objects to ROIs.
- ROIs are outlined in green. Disabled ROIs are outlined with a green-and-white dashed line.
- You can define any number of ROIs in an image.
- If you draw overlapping ROIs, processing will be performed twice in the intersection of the regions.
- The ROI pop-up menu lets you enable, disable, or remove ROIs.
- ROIs are automatically attached to the image in which they are drawn. These regions are attached to subsequent images derived from any processing operator such as a convolution or a morphological transform.
- When you save an image, any rectangular ROIs you have drawn are saved with the image. This applies only to TIFF images. You cannot save an ROI with a .bmp, .im, or .jpg image file.

## ***Drawing ROIs***

You can draw one or more regions of interest in any image window. There is no limit on the number of regions that can be defined in an image.

You can draw an ROI as a rectangle, ellipse, polygon, or freehand drawing. When you draw an ROI, the ROI is outlined in green. In the case of a freehand drawing, if the contour is not closed, it will then be automatically closed by connecting the two ends.

---

**Note:** Every image has an ROI, numbered 0, that covers the entire image. In the interface, this ROI is not displayed, and cannot be enabled, disabled, or deleted. When you draw an ROI in an image window, the original ROI is automatically disabled. When you remove or disable all drawn ROIs, the original ROI is enabled again.

If you are writing a macro using BasicScript commands, you must disable the original ROI in order to process ROIs that you have created. See AphImgAddRoi for further information and examples.

---

### To Draw an ROI

1. Open an image window or make an open image active. When you open or focus on an image window, the Image toolbar appears along the right side of the screen.
2.  Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
3. Choose the kind of ROI you want to draw.
  -  To draw a rectangular ROI, you do not need to click any additional buttons. The **Draw Rectangle** button is automatically selected.
  -  To draw an elliptical ROI, click the **Draw Ellipse** button. You can draw an ellipse along the vertical and horizontal axes only.
  -  To draw a polygonal ROI, click the **Draw Polygon** button.
  -  To draw a freehand ROI, click the **Freehand Draw** button.
4. Use the mouse to draw an ROI over the region of interest.
  - For rectangular and elliptical ROIs, drag the mouse to draw the ROI. To end drawing the ROI, release the mouse button.
  - For a polygonal ROI, double-click to end drawing.
  - For a freehand ROI, use the pen tool. Then, select it with the arrow button.
5. To draw another ROI, first click the type of ROI you want to draw (rectangle, ellipse, polygon, or freehand). Then follow step 4 above.
6. When you have finished drawing ROIs, click the **Select Objects** button to turn off the ROI drawing process and remain in ROI overlay mode.

### **Saving ROIs in a Tiff file**

When you save a TIFF image, any rectangular ROIs you have drawn are saved with the image. Non-rectangular ROIs, such as ellipses or rounded rectangles, are not saved.

---

**Note:** You cannot save ROIs in a .bmp, .im, or .jpg image file.

---

### **Disabling and Enabling an ROI**

When you draw an ROI, it is automatically enabled. You can disable an ROI, and later enable it again. When an ROI is disabled, it will not be processed when you run an operator on that image.

1.  Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the ROIs you want to disable. Press the **Shift** key to select multiple ROIs.

4. Right-click to display the Image pop-up menu.
5. Choose **ROI→Disable**. The selected ROIs are disabled, and are outlined with a green-and-white dashed line.
6. To enable an ROI that has been disabled, select the disabled ROI, then choose **ROI→Enable** from the Image pop-up menu.

### ***Moving or Resizing an ROI***

You can modify an ROI as needed, such as modifying the size or placement.

1.  Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the ROI you want to modify. When you select the ROI, handles appear along its sides and corners.
  - To move an ROI, place the cursor anywhere inside the ROI and drag it to a new position.
  - To resize an ROI, point to one of the handles along the ROI outline and drag the point to a new position.

### ***Copying and Pasting an ROI***

You can copy and paste an ROI in an image window, or from one image window to another. You can select and copy multiple ROIs.

1.  Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
2.  On the Image toolbar, click the **Select Objects** button.
3. Click to select the ROI you want to copy. When you select the ROI, handles appear along its sides and corners.
4.  On the Main toolbar, click the **Copy** button.
5.  To paste the copy into the same image, click the **Paste** button on the Main toolbar. Aphelion pastes the copy on top of the original ROI. Drag the copy to a new position.

To paste the copy into another image, open or focus on that image. Click the **Paste** button on the Main toolbar. The ROI is pasted into the active image.

### ***Deleting ROIs***

You can delete individual ROIs or all ROIs using the Image pop-up menu or the **Cut** button on the Main toolbar.

#### **To delete all ROIs**

1.  Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
2. In the image that contains the ROIs you want to delete, right click to display the Image pop-up menu.

3. Choose **ROI→Remove all**.

#### To delete a single or multiple ROIs

1. Make sure that ROI mode is enabled. To enable ROI mode, click the **Overlay** mode button at the bottom of the Image toolbar and choose **ROI**.
2. On the Image toolbar, click the **Select Objects** button.
3. Select the ROI you want to delete.  
To select additional ROIs, first hold down the **Shift** key. Or drag the cursor over the ROIs you want to select, then release the mouse button.
4. Delete the selected ROIs in one of the following ways:
  - Within any ROI, right-click to display the Image pop-up menu. Choose **ROI→Remove**.
  - On the Main toolbar, click the **Cut** button.
  - Press **CTRL+X**.

#### Converting ObjectSets to ROIs

If you have drawn a spatial attribute of an ObjectSet, you can convert the objects to ROIs. You can then perform operations on only the objects that make up the region of interest.

1. On the Image toolbar, click the **OBJ** button. A pop-up menu lists the ObjectSets attached to the active image.
2. Select the attribute you want from the pop-up menu.
3. In the Image window, select the objects you want to include in the region of interest.
  - Click to select one object.
  - To select multiple objects, hold down the **CTRL** key and click individual objects. Or drag the mouse over the objects you want to select.
4. Right click to display the Image pop-up menu. At the bottom of the pop-up menu, select the name of the ObjectSet, and then select **Convert to ROI**.
5. Refresh the image by closing and then reopening it.

To reopen the image, click the **Image List** button on the Objects toolbar and select the image name.

After you have converted the ObjectSet to an ROI, you can remove or disable one or more of the objects from the region of interest.

#### Converting Graphic Overlay Objects to ROIs

You can convert graphic overlay objects that you have drawn, including rectangles, ellipses, or polygons, to regions of interest.

1. Draw the graphic objects in the image. (Graphic objects are outlined in blue.)
2. Select the graphic objects you want to convert to regions of interest.
3. Right-click to display the Image pop-up menu. Choose **Graphic→Convert to ROI**.

4. Select the graphic objects (outlined in blue), and move them or click the Cut button. The ROIs (outlined in green) will be visible in the image.

After you have converted the graphic objects to ROIs, you can remove or disable one or more of the objects from the region of interest.

## ObjectSets

An ObjectSet overlay represents one spatial attribute from an ObjectSet, such as a set of lines or regions. The ObjectSet is computed by one of the segmentation operators. Typically, these operators automatically create the ObjectSet overlay.

Custom ObjectSet overlays can be drawn using the AphObjDraw and AphObjDrawMapped operators. These operators allow control over the overlay color, line width, and fill properties. In addition, the AphObjDrawMapped operator can use a scalar attribute to draw the objects with a range of gray scales.

A number of operations can be performed on ObjectSet overlays. This includes changing drawing attributes, selecting objects, converting ObjectSets to ROIs, and removing object overlays.

### The Image Pop-up Menu

Each ObjectSet overlay creates an entry on the pop-up menu associated with the image in which the overlay is drawn. You can use these entries to select an ObjectSet, and change the line properties or convert the ObjectSet to an ROI.

### *Deleting ObjectSet Overlays*

The entire ObjectSet overlay can be deleted in two ways:

- Choose **Delete all** from the Image pop-up menu.
- Run the AphObjRemoveOverlay operator.

To remove individual objects, first select the objects. Then click the **Cut** button.

---

# Charts

In Aphelion, histograms, profiles, surface maps, and scatter plots are referred to as **charts**. They are displayed in chart windows that provide a great deal of flexibility for displaying information.

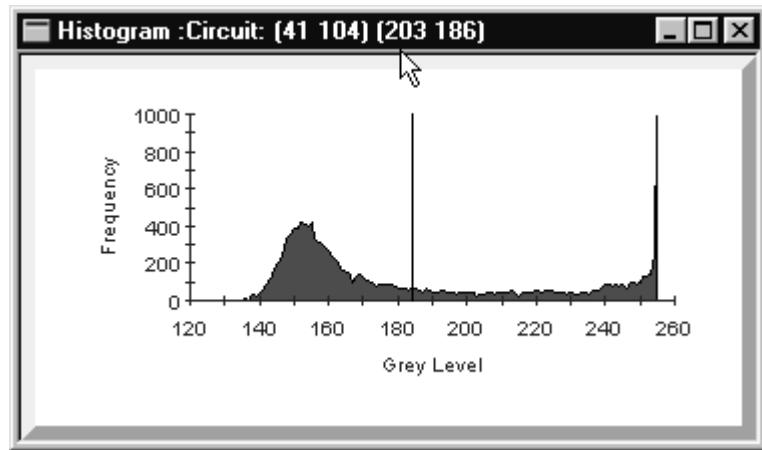
You can modify the display properties of a chart, create models to use when you create new charts, and establish defaults for the size and position of chart windows in Aphelion.

Aphelion supplies models for the following types of charts:

- Histogram
- Profile
- Surface Map
- Scatter Plot

## Image Histograms

Chart windows can be created to show intensity histograms of selected areas of an image or of the whole image.



**Note:** To view information about the histogram in the Info page of the Info/History/Messages window, choose **View→Info Window Output→Histogram/Profile Values** from the Aphelion menu bar.

You can create an image histogram in one of the following ways:

-  Create a histogram for a rectangular area of interest. See Drawing a Histogram.
- Create a histogram for an entire image. To create a histogram for an entire image, display the Image pop-up menu and choose **Operators→Histogram**. See Using the Histogram Command.
- Use one of the following operators to compute a histogram on either the entire image or on ROIs drawn in the image. You can copy the code from the History pane to use in a macro.
  - AphImgHistogram
  - AphImgBandHistogram

You can also create a histogram based on ObjectSet data.

- ISR Histograms
- AphObjHistogram

**Note:** To display intensity profiles along a line, see Image Profiles.

### Drawing a Histogram

To create a histogram for a rectangular area of interest, use the **Histogram** button on the Image toolbar. Dynamic coloring is not available for this type of histogram.

1. Open or select the image to be used.
2.  On the Image toolbar, click the Overlay button, and choose **Histogram**.
  - When you click the Histogram button, the Rectangle button is automatically activated.
  - The shape of the cursor turns into a cross-hair.

3. Drag the mouse to draw the area of interest. When you release the mouse button, the histogram is displayed in a chart window. The title bar of the chart window includes the name of the source image and the coordinates of the rectangular area of interest.

**Note:** If you click on a point in the histogram chart, the position and value of that point are displayed in the Statusbar. If you want to view that information in the Info page, and be able to save it or copy it to a macro, choose **View→Info Window Output→Histogram/Profile Values** from the menu bar.

## ***Modifying a Histogram***

You can modify a histogram by moving, resizing, or deleting the histogram rectangle drawn in the image. The changes are reflected in the histogram window. You can also change the line color of the rectangle.

### **To move or resize the rectangular area of interest**

When you move or resize the rectangular area of interest for a histogram, the chart window interactively reflects the changes.

1.  On the Image toolbar, click the **Select Objects** button.
2. Select the rectangle you want to resize or move.
3. Choose one of the following options:
  - To move the rectangle, click anywhere inside the selected rectangle and drag the rectangle to a new position.
  - To resize the rectangle, click a selection point and drag the side or corner to a new position.

### **To change the histogram line color**

1.  Make sure that Histogram mode is activated.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the histogram you want to modify.
4. Choose the Line Color option in one of the following ways:
  - On the Image toolbar, click .
  - From the Image pop-up menu, choose **Histogram→Line Color**.
5. The Color dialog box appears.
5. Select the color you want and click **OK**. The line color of the selected histogram changes to the color you selected.

### **To delete a histogram**

When you delete the drawn region of interest, the histogram window is also deleted.

1.  On the Image toolbar, click the **Select Objects** button.
2. Select the region of interest representing the histogram you want to delete.
3.  Click the **Cut** button on the Main toolbar or press **CTRL+X**.

---

**Note:** When you close a histogram window, the region of interest remains drawn with the image. When you reselect the region of interest, the histogram window is restored.

---

## **Using the Histogram Command (Image pop-up menu)**

When you use this method to create a histogram, you can use dynamic coloring to highlight an area in the histogram, which is then reflected in the image. Dynamic coloring is available only for gray scale histograms.

1. Open or select the image to be used.
2. Click the right mouse button to display the Image pop-up menu.
3. Choose **Operators→Histogram**. The histogram is displayed in a chart window. The title bar of the chart window displays the name of the source image.

### **To use dynamic coloring**

When you create a histogram of a gray scale image using the Histogram command, you can use dynamic coloring to view a range in both the Histogram and Image windows. You first select a range in the Histogram window, which is highlighted with a color. The selection is reflected in the Image window using the same color. If you modify the range you selected in the Histogram window, the Image window is also updated.

You can highlight as many ranges as needed, and change the color for any range.

1. In the Histogram window, start at the leftmost point you want to work with.
2. Highlight ranges in the histogram. As you highlight a range in the histogram, the corresponding area is highlighted in the image.
  - Drag the mouse from left to right to highlight a range of the histogram.
  - To highlight multiple ranges, continue to work in the chart from left to right. You can select as many ranges as you need. Different colors are used for each range, up to 5. (After that, you can use the Selection→Color command to change the color of a range.)
3. If you need to clear one or more ranges, click the right mouse button and choose **Selection**.
  - **Delete selection.** This command deletes only the selection where the mouse is positioned.
  - **Delete all selections.** This command deletes all selections. Use this command when you want to clear the ranges and start over.
4. You can change the color used in dynamic coloring. Place the mouse over the range you want to change, then right-click to display the pop-up menu. Choose **Selection→Color**. Choose a color from the Color dialog box and click **OK**. The color is changed in both the Histogram and Image windows.

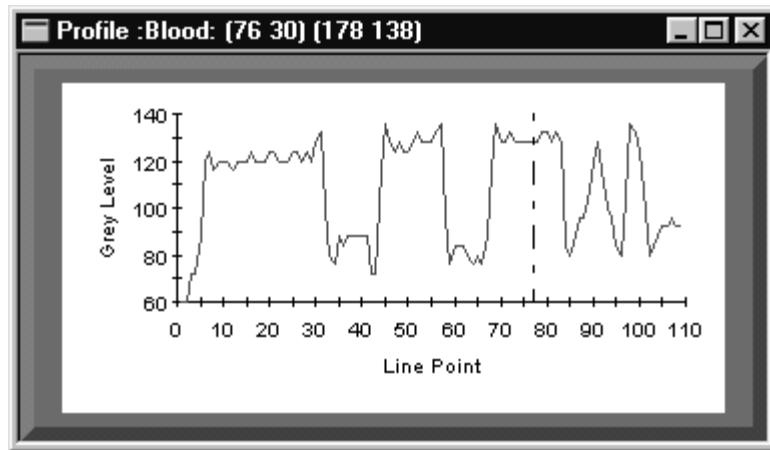
---

**Note:** The Statusbar displays the gray level (x) and frequency (y) of the point where the cursor is positioned on the histogram.

---

## **Image Profiles**

You can create multiple windows that show intensity profiles of selected lines in an image. You can use message passing to specify points on the profile, and automatically mark those points in the image.



The values on the X axis of the graph correspond to the distance between the two end points selected for the profile. You can select one point on the chart, and display the exact values in the Statusbar at the bottom of the Aphelion screen. The output has the following format:

Distance: (X,Y): Intensity

- Distance is defined as max ( $|X_2-X_1|$ ,  $|Y_2-Y_1|$ )
- (X,Y) are the exact coordinates, in pixel units
- Intensity is the gray scale intensity

---

**Note:** To view information about the profile in the Info page of the Info/History/Messages window, choose **View→Info Window Output→Histogram/Profile Values** from the Aphelion menu bar.

---

You can create a profile in one of the following ways:

- On the Image toolbar, make sure that Profile mode is activated. To activate Profile mode, click the Overlay button, and then click **Profile**. Then draw the profile line in the image.
- Run the AphImgProfile operator.

### Drawing an Image Profile

1. Select the image to be used.
2.  On the Image toolbar, make sure that Profile mode is activated. To activate Profile mode, click the Overlay button, and then click **Profile**.
  - When you click the Profile button, the Line button is automatically activated.
  - The shape of the cursor turns into a cross-hair.
3. Drag the mouse to draw a line over the area of interest. When you release the mouse button, the profile is displayed in a chart window. The title bar of the chart window includes the name of the source image and the coordinates of the profile line.

---

**Note:** If you click on a point in the profile chart, the position and value of that point are displayed in the Statusbar. If you want to view that same information in the Info page, and be able to save it or copy it to a macro, choose **View→Info Window Output→Histogram/Profile Values** from the menu bar.

---

## **Modifying an Image Profile**

You can modify an image profile by moving, resizing, or deleting the profile line drawn in the image. The changes are reflected in the profile window. You can also change the line color.

### **To move or resize the profile line**

1.  Make sure that Profile mode is activated.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the line you want to modify.
4. Modify the line as needed.
  - To move the line, place the cursor anywhere on the line except for the end points, and drag the line to a new position.
  - To resize the line, point to an endpoint. Hold down the mouse button until the cursor turns into a double-headed arrow. Drag the end to a new position.

### **To change the profile line color**

1.  Make sure that Profile mode is activated.
2.  On the Image toolbar, click the **Select Objects** button.
3. Select the line you want to modify.
4. Choose the Line Color option in one of the following ways:
  -  On the Image toolbar, click the Line Color button.
  - From the Image pop-up menu, choose **Profile→Line Color**.  
The Color dialog box appears.
5. Select the color you want and click **OK**. The line color of the selected objects changes to the color you selected.

### **To delete an image profile**

To delete an image profile, you delete the profile line that is drawn in the image. When you delete the line, the profile window is also deleted.

1.  On the Image toolbar, click the **Select Objects** button.
2. Select the line representing the profile you want to delete.
3.  Click the **Cut** button on the Main toolbar or press **CTRL+X**.

---

**Note:** When you close a profile window, the line remains drawn with the image. When you reselect the line, the profile window is restored.

---

## **Using AphImgProfile**

You can use AphImgProfile to create an image profile. The AphImgProfile operator provides exact control over the specifications of the profile line.

1. Open or select the image to be used.
2.  In the Operator dialog box, click the Select Operator button.

3. Choose **Analysis→Interactive→ImgProfile**.
4. In the Operator dialog box, click the Image input icon and select an image. The profile is displayed in a chart window.
5. Use the Point Set fields in the Operator dialog box to specify the pixel coordinates of the selected profile line.
6. You can use message passing to specify a point on the profile, and see the corresponding point in the Image window.
  - If you click on a point in the profile chart, the corresponding point in the image is marked with an X.
  - If you drag the mouse over a range of points in the profile chart, the corresponding area in the image is marked by X's.

---

**Note:** To draw additional lines in the image, click the Plus sign button in the Operator dialog box.

---

## Image Surface Maps

For any open image, you can draw a surface map. To change the properties of the surface map, use the Olectra Chart tabbed dialog box.

1. Focus on an image.
2. Click the right mouse button to display the Image pop-up menu.
3. Choose **Operators→Surface Map**. A chart window containing the surface map opens.
4. In the surface map window, click the right mouse button to display the Chart pop-up menu.
5. Choose **Properties**. The Olectra Chart tabbed dialog box opens. From this dialog box, you can change many properties such as color and labels.

For example, you can:

- Change the background color. Click the **PlotCube** tab, then select the **Interior** tab. Under Background color, click the RGB box. The Color dialog box opens. You can then select a color and click **OK**.
  - Change the appearance of the elevation and contour data. Click the **ChartGroup** tab. On the General tab, check **IsZoned** and **IsMeshed** and **IsShaded** to enhance the display.
6. After you have changed properties, click **OK** to return to the Aphelion workspace.

---

**Note:** When you display the Olectra Chart tabbed dialog box, you can click the Help button at any time to display context-sensitive Help.

---

## Object Histograms

### To draw an ISR Histogram

To create an IsrHistogram, use the pop-up menu from a grid and choose **Histogram**. See Grid Documents for more information.

## Scatter Plots

You can create a scatter plot, based on two attributes in an ObjectSet. A scatter plot is displayed in a chart window.

1. Display a grid.
2. Select the columns in the grid that represent the data sets (ObjectSet attributes) of interest. You must select two columns.
3. Click the right mouse button to display the Grid pop-up menu.
4. Choose **Scatter**. Aphelion displays a chart window containing the scatter plot. The title bar of the chart window displays the name of the grid and the two ObjectSet attributes that the scatter plot is based on.

## Setting Chart Options

You can change the default models for each type of chart, or create new models. Use the **Options→Charts** command from the menu bar to specify which model you want to use for a particular kind of chart.

- Chart model files, which store only the properties for a particular type of chart, have the extension **.apc**.
- Files that store both the data and the properties of a chart have the extension **.oc2** or **.oc3**.

### Modifying the Properties of a Chart

When you create a chart, you can change the properties of the chart window using the Olectra Chart tabbed dialog box. For example, you can change the colors of the foreground and background of various areas of the chart, or modify the style of the chart. When you make these changes, you can save them as a model to use when you generate other charts.

### To Change the Colors in a Chart

To change the colors in a chart, you generally use the **Interior** tab for the area of the chart you want to modify. The following screen shows the names for the areas of the chart, as used in the Olectra Chart Control Properties dialog box.

1. Display the chart you want to modify.
2. Right-click to display the Image pop-up menu.
3. Choose **Properties**. The Olectra Chart Control Properties dialog box opens.
4. To change the colors of the chart, choose the following combination of tabs:

To change the color of the	Use this tab
Border of a chart	Control→Interior
Axes foreground and background	ChartArea→Interior
Plot area	PlotArea→Interior
Plot charts	ChartStyle→LineStyle ChartStyle→Symbol Style
Area and bar charts	ChartStyle→FillStyle

After you modify the chart, you can save the properties and characteristics as a model. You can use the model when you create other charts of the same type.

## Saving a Chart

You can save a chart file, which saves both the chart data and the chart properties, such as the style of the border, colors, titles, and other properties. Chart files have the extension .oc2 or .oc3.

1. Create a chart, such as a histogram or profile.
2. From the chart window, click the right mouse button to display the Chart pop-up menu.
3. Choose **Save Chart**.
4. In the Save As dialog box, type a name for the chart file in the Save As dialog box.
5. Click **Save**.

## Loading a Chart

If you have saved a chart, such as a histogram or profile, you can load the chart in a chart window. From a chart window, click the right mouse button to display the Chart pop-up menu. Choose **Load**, then select the chart you want to load.

## Changing the Size or Location of a Chart Window

You can change the default size and location of the chart window for each type of chart. The new default settings can be applied to the current Aphelion session only or saved as part of a project. There are four types of chart windows in Aphelion:

- Histogram
- Profile
- Surface Map
- Scatter Plot

### To set chart window defaults

1. Open an image, and create a chart such as a histogram.
2. Move the window to the size and position you want to establish as the default.
  - To resize the chart window, drag on one of the sides or corners of the window.
  - To move the chart, hold down the mouse anywhere along the title bar and drag the window.
3. Click the right mouse button to display the Chart pop-up menu. You set the defaults for size and position separately.
  - Choose **Set Defaults→Size** to set the size.
  - Choose **Set Defaults→Position** to set the position.

The next time you open a chart of that type, it will use the default size and position

4. To save the defaults as part of the project file, make sure that **Save Images in the project** is selected in the Preferences dialog box. To check the setting, choose **Options→Preferences** from the menu bar.

## Creating a Chart Model

After you modify the display properties of a chart, you can save the properties as a model. You can use the model when you create other charts of the same type.

- If you overwrite the existing default model, the file will automatically be associated with the chart type.
- If you save a new model file, you must then use the Options menu to specify that model file as the default for a chart type.

### To save chart characteristics as a model

1. Use the Olectra dialog box to change the properties of the chart.
2. From the chart, right-click to display the Chart pop-up menu.
3. Choose **Save Model**.
4. Save the model file. Model files have the extension **.apc**. You can overwrite the default model file for a particular type of chart, or create a new model file. The default chart model files are:
  - Histogram.apc
  - Profile.apc
  - Surface.apc
  - ScatterPlot.apc
5. If you overwrite one of the existing model files, you do not need to make any further changes. If you create a new model file, you need to specify that model file as the default for a specific chart type.

### To specify a chart model as a default

If you save a new model file (.apc), other than the default model for a particular type of chart, you must specify that model file in the **Options→Charts** dialog box for the particular type of chart. **Note:** This setting is saved in the project file if **Save images in the project** is selected in the Preferences dialog box.

1. From the **Options** menu, choose **Charts**.
2. In the Chart Options dialog box, click the drop-down arrow in the Model Name field. Choose the type of chart for which you are specifying a model.
  - Histogram
  - Profile
  - Surface Map
  - Scatter Plot
3. In the Model Description file field, click the Browse button (...), and select the chart model file that you created. Model files have the extension **.apc**.
4. Click **OK**. All charts of the type you selected will now automatically use the specified model file.

---

# Message Passing

Message passing is a mechanism that sends messages between images, allowing you to view the same information in different formats. You can use message passing between images containing object overlays and a grid or chart document, or between image windows. For example, when you draw an intensity profile line across an image, the image window and the chart window are automatically linked. If you modify the profile line in the image overlay, the profile is updated in real-time.

Message passing is currently available between:

- An image with a graphic overlay and a grid
- An image and a chart document (profile or histogram). You cannot use message passing with a scatter plot or surface map.
- Two or more image windows

Message passing between an image window and a grid is especially useful for object measurements. You can highlight objects in the image and view the associated measurements in the grid.

Message passing between two or more image windows is especially useful when you want to zoom in one image, and examine the same area in another window.

You can also use message passing to display objects based on specific attributes. For example, you might want to highlight objects with the smallest or highest value of a particular attribute. This can be accomplished by sorting the grid rows by the attribute, and then selecting the top or bottom rows. See the Message Passing Tutorial for more information.

## Message passing between an image and a chart

Message passing is available between a chart (profile or histogram) and an image. You can select multiple ranges in the chart, and view the corresponding pixels in the image.

---

**Note:** Dynamic coloring between an image and a histogram is available only for histograms created using the **Operators→Histogram** option on the Image pop-up menu.

---

1. Open the image you want to work with.
2. Create a profile or histogram.
  -  To create an intensity profile chart, click the Profile button on the Image toolbar, then draw a profile line by dragging in the image.
  - To create a histogram that uses message passing, click the right mouse button to display the Image pop-up menu. Choose **Operators→Histogram**.
3. Changes or selections to the profile or histogram chart are reflected in the image.
  - If you click on a point of the profile line, the corresponding point in the image is marked with an X.
  - If you select a range in the chart, the corresponding range is shown in the image.
4. Changes to the profile line in the image are reflected in the chart.
  - Activate the image window.
  -  On the Image toolbar, click the Select button.

- Modify or move the profile line. The chart is updated to reflect the changes.

## Message passing between an image and a grid

Messages can be passed from an image overlay to a grid, or from a grid to an image overlay. To pass messages from a grid to an image overlay, select the grid rows you are interested in. They are automatically highlighted in the overlay display. To pass messages from an image overlay to a grid, first select which ObjectSet will be used. Then select an object from the image overlay, and the corresponding row in the grid is highlighted.

To use message passing, you must first:

- Display an ObjectSet in the image window as an overlay
- Open a grid document containing the ObjectSet information

To pass messages from an image overlay to a grid, you must also enable ObjectSet mode by selecting an ObjectSet.

### To display an ObjectSet

You can display an ObjectSet in either of the following ways:

- Run an operator whose name ends with Obj, such as AphImgGrowObj, to create an ObjectSet associated with an image.
- If the ObjectSet is already computed, use the ObjDraw operator to display the ObjectSet on top of an image. All objects are outlined in the selected color. The default color is yellow. To change the default color, use the advanced parameters for ObjDraw.

---

**Note:** The operator AphImgClustersObj creates an ObjectSet from a binary image. If you want to perform a classical individual analysis to compute measurements on objects, such as the surface and shape factors of blobs, create a threshold by running AphImgThreshold. Then use AphImgClustersObj to generate an ISR object that contains basic measurements. As shortcut to these two steps, use the AphImgThresholdObj operator.

---

### To open a Grid Document

1.  On the Objects toolbar, click the ObjectSet list button. The drop-down list of available ObjectSets is displayed.
2. Select an ObjectSet from the drop-down list to open the grid window. Each row within the grid represents an object.

### To enable Overlay to Grid Message Passing

Only one ObjectSet can be used to pass messages from an image overlay to a grid. To select an ObjectSet, follow this procedure:

1. Activate the image window containing the Object overlay you want to work with. (To select the image window, click anywhere in the image.)
2.  Click the **ObjectSet** button on the Image toolbar. A drop-down list of available ObjectSets is displayed.
3. Select the ObjectSet you want to use for message passing.

### To use Message Passing

After you have established the proper message passing settings, you use message passing as follows:

1. Select one or more objects in the image overlay or in the corresponding grid.
  - To select an object (row) in the grid, click the row number. The selected rows are highlighted in blue. You can select multiple rows.
  -  To select objects in the image, click the **Select Objects** button on the Image toolbar, then click on the object you want to select. To select multiple objects, hold down the **CTRL** key, or drag the cursor across the objects. The outline of the selected objects turns red.
2. View the corresponding objects and measurements:
  - If you select objects in the grid document (row), the corresponding objects are outlined in red in the image overlay.
  - If you select objects in the overlay, the corresponding rows are highlighted in blue in the grid document.

## Message passing between images

Messages can be passed between two or more image windows. The image that sends the messages is called the **source** image, and the images that receive messages are called the **target** images. You can specify only one source image, but multiple target images.

### To set up messages

1. Open the images that you want to use for message passing. You can pass messages from one image to multiple images.
2.  On the Objects toolbar, click the **Message Passing** button. The Message passing dialog box opens.
3. In the left section of the window, select the image to use as the source image. You can select only one source image.
4. In the right section of the window, select the target images. To select more than one target image, hold down the **CTRL** key.
5. In the bottom section of the window, select what type of messages you wish to send: zoom, scroll, or both zoom and scroll (All messages).
6. Click the **Close** button to close the Message passing window. You can now pass messages between the selected image windows.

---

**Example:** Run the Blood.apm macro. Keep the images open. Click the Message Passing button, select the images you want to use for message passing, select All messages in the bottom of the window, then close the window. Click the Zoom button on the Image toolbar, and drag the mouse in the source image. The corresponding areas of the target images zoom as well.

---

## Tutorial: Message Passing

This tutorial demonstrates how to use message passing between an image and a grid. In this tutorial, you first display the ten largest objects in the overlay. Then you delete the 5 darkest objects.

### To enable Message Passing

1.  On the Main toolbar, click the Open button. Open the image blood.tif.
2. Select the ImgThresholdObj operator.
  - For the input image, choose blood.tif.
  - In the Output Objectset field, type a name for the ObjectSet you are creating.
  - For parameters, use 40 for the Low value and 100 for the High value.Run the operator.
3. Select the ObjComputeMeasurements operator.
  - In the Input ObjectSet field, click the drop-down arrow and select the ObjectSet you created when you ran ImgThresholdObj.
  - Do not click the Select button to select specific measurements; all measurements will be calculated.Run the operator.
4.  If the ObjectSet did not open automatically, click the **ObjectSet List** button and select the ObjectSet you created. The grid window opens, displaying the measurements that were computed.
5. Make sure that you can view both the grid and the image at the same time.
6. To use message passing from the grid to the image view, select rows 6 through 8 in the grid. The corresponding objects are highlighted in the image.
7. To use message passing from the image to the grid:
  - Focus on the image
  -  Click the **OBJ** button on the Image toolbar and select the ObjectSet from the pop-up list
8. Select one or more objects in the image. The corresponding rows are highlighted in the grid.

#### To display the ten largest objects in the overlay

1. Select the column labeled AREA by clicking the left mouse button on the AREA title.
2. Click the right mouse button to display the grid pop-up menu.
3. Select the **Sort by column** command. The rows in the grid are automatically sorted in descending order, with the largest object in the first row of the grid.
4. Select the first ten rows, by clicking the left mouse button on the index of each row. To deselect a row, click it again.

In the image overlay, the ten largest objects appear outlined in red.

#### To remove the five darkest objects

1. Select the column labeled INTENSITY\_MEAN.
2. Scroll to the bottom of the grid and select the bottom five rows.
3. Choose **Delete Rows** from the grid pop-up menu.
4. The objects (rows) will be removed from the grid, and from the object overlay.

---

## Macros

A work session can be recorded in a macro file using BasicScript language, which is fully compatible with Visual Basic™. In addition, Aphelion operators have been added to the language library.

A macro file can be edited, debugged, and played, providing a convenient way to automate your work. Macros are created using BasicScript code and the Aphelion operator commands. You can construct a macro using the record capability or by typing code directly. A macro file has the extension .apm.



For information about the macros that are distributed with Aphelion and an annotated example of the macro Ceramic.apm, see Getting Started: Aphelion Macros.

## BasicScript Commands

Most of the BasicScript commands may be used to construct macros. However, some commands provided in BasicScript for forms control may not be useful in creating macros. Nested control structures are supported and variables are declared in the same manner.

The macro text is color-coded in the following manner:

Commands and comments:Purple

Code: Blue

Breakpoints: Red

The following partial list of BasicScript commands can be used to provide mathematical capability, program control, user messages, and documentation.

```
Sub, End Sub
Function, End Function
DIM
If, Then
If, Then, Else
Do....Loop
For....Loop
For....Next
Next
All Math Functions
MsgBox
MultiBeep
Exit
` (For user comments)

String management commands and control boxes
SelectBox
```

```
AskBox$  
InputBox$  
MsgBox  
CInt  
Len  
InStr  
StrComp  
Chr$
```

For more BasicScript commands, see the *Macro Language Reference Guide*.

## Macro Comment Usage

### To enter a full line comment

1. Type an apostrophe ( ' ) at the start of the line.
2. Type the comment following the apostrophe. The text of the comment appears in purple.

### To enter a comment at the end of a line of code

1. Position the insertion point in the empty space beyond the end of the line of code.
2. Type an apostrophe ( ' ).
3. Type comment following the apostrophe. The text of the comment appears in purple.

## Opening a Macro Window

Macro windows provide a flexible way to create, load, and run macros. You can have multiple macro windows open, which allows you to cut, copy, and paste code between macro windows.

### To open a macro window

1. From the **File** menu, choose **New**. The New dialog box opens.
2. Choose **Macro Document** and click **OK** to open a macro window.

You can also open a macro window with a macro already loaded. See Loading a Macro.

## Loading a Macro

You can load a macro by opening a macro window and selecting a macro to load. Or you can use the **Macros** button on the Objects toolbar as a shortcut.

You can record a macro by recording the execution of Aphelion operators or other tasks. See Recording a Macro.

### **Loading a Macro from the Toolbar**

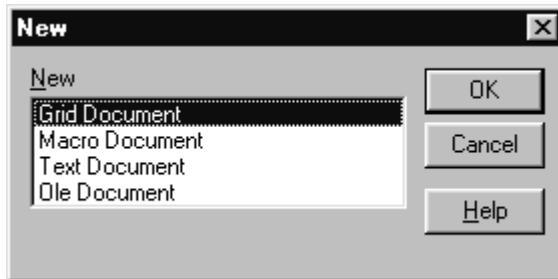
 Use the Macros button on the Objects toolbar as a shortcut to load a macro. When you click the Macros button, the macro menu is displayed.

{bml m\_macros.bmp}From the menu, you can list the Macros directory or the Examples directory. Select a macro from the list. A macro window opens with the macro loaded.

A list of all macros in the current macro directory is displayed at the bottom of the macro menu. To change the current macro directory, use the Load command in the macro window and select a macro from another directory. The new directory becomes the default. For more information, see Changing the Default Macro Directory.

### ***Loading a Macro from the Macro Window***

1. From the **File** menu, choose **New**. The New dialog box opens.



2. Choose **Macro Document** and click **OK** to open a macro window.
3. In the macro window, click the right mouse button to display the Macro pop-up menu.
4. Choose **Load** to display the Open dialog box.
5. Highlight the macro you want to load. Macro files have the extension .apm.
6. Click **Open**. The macro is loaded into the macro window.

---

**Shortcut:** To bring up the Open dialog box for macros, press **CTRL-M**.

---

### ***Changing the Default Macro Directory***

When you first start Aphelion, the default macro directory is the \Aphelion directory. The default macro directory controls:

- what macros files are listed when you click the Macros button on the Objects toolbar
- what directory is listed when you click the **Load** command from a Macro window

#### **To change the default directory**

1. From the **File** menu, choose **New**.
2. In the New dialog box, select Macro document and click **OK**.
3. In the Macro window, click the right mouse button to display the Macro pop-up menu.
4. Choose **Load**. The Open dialog box appears, listing the macros in the current default directory.
5. Change directories, and select a macro from another directory. Click **Open**. The new directory becomes the default macro directory.

---

 You can use the Macros button for easy access to the macros supplied with Aphelion. Click the **Macros** button, then choose either **Macros** or **Examples**.

---

## Running a Macro

While a macro is running, you can perform other operations in the GUI. However, it is not advisable to run Aphelion image processing operators during the execution of a macro. The Play Macro button remains grayed until the macro is completed.

---

**Note:** When a macro is running, the macro window cannot be closed. To stop a running macro, click on the **Stop Debug** button, and then close the window.

---

### To run a macro

1. Load a macro into the macro window. To load a macro, you can:
  - Use the Load command from the macro window.
  - Click  on the Objects toolbar. Choose the Macros or Examples directory, or select a macro from the default directory.
  - Record the execution of an Aphelion operator or other Aphelion tasks.
2.  Click the Play Macro button. Aphelion executes all the code in the current macro, except comment lines. Message boxes and other standard Visual Basic commands are executed.

---

**Note:**  To run a macro step-by-step, click the Step Into button.

---

## Recording a Macro

When you use the Start Recording button, the current macro window is cleared and a new macro window appears with the command `main`. Be sure the current code has been saved before you record a new macro. See Saving a Macro for more information.

When you click the Stop Recording button, the command is automatically appended to the end of the recorded code.

1. From the **File** menu, choose **New**. The New dialog box opens.
2. Choose **Macro Document** and click **OK**. A macro window opens.
3.  From the macro window, click the Start Recording button.
4. In the Aphelion interface, perform the actions you want included in the macro. Each action is recorded as a line of BasicScript code.
5.  From the macro window, click the Stop Recording button
6. The command `End Sub` is automatically appended to the end of the recorded code.

---

**Note:** Any macro can be attached to a button on the Objects toolbar. See Macro and Application Toolbar Buttons for more information.

---

## Saving a Macro

When you record a macro, be sure to save the macro so that it will be available to be run or modified. If you forget to save the macro, Aphelion automatically saves the macro in the Aphelion\tmp subdirectory.

### To save a macro

1. Record the macro.
2. Right-click anywhere in the macro window to display the Macro pop-up menu. On some PCs, you may need to right-click in the area of the Macro toolbar to display the Macro pop-up menu.
3. Choose **Save**.
4. Type a name for the macro in the **File name** field.
5. Click **Save**.

---

**Shortcut:** To save a macro, click  on the Main toolbar.

---

**Note:** Macros are automatically saved on disk in the Aphelion\tmp sub-directory. The filename of the automatically saved file includes "\_sav" as the last four characters before the .apm extension. Example: Macrol\_sav.apm

If you uninstall Aphelion, these automatically saved files are treated like user-created files and are not deleted.

---

## Editing a Macro

After you load a macro, you can edit the file. You can also copy information from other macro windows, or from the Info/History/Messages window.

### To change the font size

You can change the font size for the text in a macro. You can change the font only for the entire text, not for selected text.

1. Click the right mouse button to display the Macro pop-up menu.
2. Choose **Font**. The Font dialog box is displayed.
3. Select the font, font style, and size.
4. Click **OK**. The text in the macro window changes to the attributes you selected.

### To edit a macro

You can use the Macro pop-up menu to select editing commands such as cut, copy, and paste. After you select text in the macro window, you can also use the Cut, Copy, and Paste buttons on the Main toolbar.

1. Select the text you want to copy or cut.
2. Click the right mouse button to display the Macro pop-up menu.
3. Choose **Edit**. From the Edit menu, you can choose Clear, Cut, Copy, Paste, or Undo. You can click Undo (or press CTRL+SHIFT+Z) multiple times to reverse multiple actions.

---

**Note:** If you choose **Clear**, it clears the entire macro window.

---

## Macro Library

You can create a macro library which contains frequently used macros. This makes it possible to call one macro from another. The called macro can be located in the same or a separate directory.

The macro library also makes it possible to pass arguments to a macro. This may include a list of images, integer values, text strings, or other arguments.

---

**Note:** You can create only one macro library.

---

### *Creating the Macro Library*

1.  Click the **Macros** button on the Objects toolbar.
2. Choose **Macro Library** The Macro Library dialog box opens.
3. Click the **F** button to display the Open dialog box, listing all macros files in the Macros subdirectory. If needed, you can change the directory to access other macro files.  
**Note:** Macro files have the extension **.apm**.
4. Select the macros you want to include in the macro library. To select multiple macros, hold down the **CTRL** key.
5. Click **Open**. All the macros appear in the Macro name field.
6. Click **Add** to add the macros to the macro library. The macros are listed in the **Files in Library** section at the top of the dialog box.
7. Click **Close**.

### *Changing the Macro Library*

#### To add a macro to the macro library

1. Open the macro that you want to add to the macro library.
2. With the cursor positioned in the macro window, click the right mouse button to display the pop-up menu.
3. Choose **Add To Macro Lib.** (To view the list of macros in the Macro Library, click the Macro List button on the Objects toolbar, then choose **Macro Library**.)

#### To remove a macro from the library

1. Click the **Macros** button on the Objects toolbar.
2. Choose **Macro Library** The Macro Library dialog box opens.
3. Select the macro. To select multiple macros, hold down the **CTRL** key.
4. Click **Remove**.

## Macro Watch Variables

Watch variables are useful to debug a macro or to add a test or a loop to a macro. There are two ways to display the value of a variable.

- Display the value in a message box using the MsgBox command.
- Use the watch variable feature provided with the debugger. This method is more efficient. Each time the value of the variable changes, the new value appears in the macro window.

You can only watch variables of fundamental data types, such as Integer, Long, and Variant; you cannot watch complex variables such as structures or arrays. You can, however, watch individual elements of arrays or structure members using the following syntax:

```
[variable [(index, . . .)] [.member [index, . . .]] ...]
```

Where variable is the name of the structure or array variable, index is a literal number, and member is the name of a structure member.

Example:  
Dim a (10)  
watch a (5)

### **Adding or Deleting a Watch Variable**

#### To add a watch variable

1.  On the Macro toolbar, click the **Add Watch** button to open the Add Watch dialog box.
2. In the **Variable** field, enter the name of the variable you want to watch.
3. In the **Procedure** field, type the name of the routine in which the variable is defined. For example, type `main` to watch the value in the routine `main`.
4. Click **OK**.

---

**Note:** Although many watch variables can be added to the list, the watch area only expands until it fills half the Macro window. Scroll bars are provided for long lists. You can adjust the size of the watch area using the mouse to move the bar between the macro window and watch list area.

---

#### To delete a watch variable

1. Select the variable on the watch list.
2. Click **Delete**.

## Debugging a Macro



### Set Breakpoint

Use the Set Break Point button to set a breakpoint in the macro so that processing will stop at a specific line of code and not resume until the Play button is clicked again. You can place multiple break points in a macro. Break points appear in red in the code.

To remove a break point, highlight the line of code and click the Set Break Point button again. To clear all break points, right-click in the macro area, then select **Debug:Clear Break Points**.

Example of code without a breakpoint - Highlight line of code chosen for breakpoint and click the Set Break Point button.

```
Sub main
    a=10
    b=12
    c=20
    MsgBox a*b
End Sub
```

Example with a single line of code highlighted. - Click the Play button to start execution of macro.

```
Sub main
    a=10
    b=12
    c=20
    MsgBox a*b
End Sub
```

Example of set toggle breakpoint - Code is red

```
Sub main
    a=10
    b=12
    c=20
    MsgBox a*b
End Sub
```

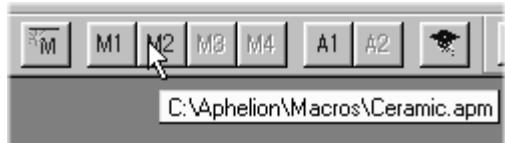
Example showing highlighted code when execution stops - Click the Play button again to continue with execution of the macro

```
Sub main
    a=10
    b=12
    c=20
    MsgBox a*b
End Sub
```

## Macro and Application Toolbar Buttons

You can attach a macro you have written to one of the four UserMacro buttons (M1-M4) on the Objects toolbar. You then click the UserMacro button to run the attached macro file. You can also attach any application to one of the two Application buttons (A1-A2).

After you attach a macro or application to a toolbar button, the button is available (not gray), and the tooltip for that button displays the pathname of the macro or application. Buttons that are not attached to a macro or application are grayed.



### **Attaching a Macro or Application Button to the Toolbar**

1. On the Objects toolbar, click the AttachMacro button to display the Attach a macro to toolbar dialog box.
2. To attach a macro to a button, select one of the four macro buttons. To attach an application to a button, select one of the two application buttons.



3. Under File name, click the Open button to display the Open dialog box.
4. Select the macro file or application you want to attach and click **Open**.
  - Macro files have the extension **.apm**.
  - Application files have the extension **.exe**.
5. Click **OK**.

### **Modifying a Macro or Application Button**

1. On the Objects toolbar, click the AttachMacro button to display the Attach a macro to toolbar dialog box.
2. Select the button you want to detach.
3. Delete the file name in the File name field. Make sure the field is empty.
4. Click **OK**.

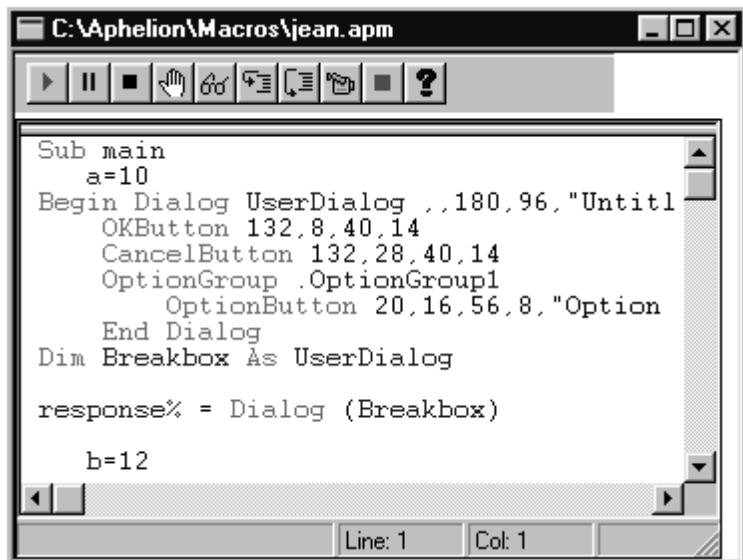
---

**Note:** To change an attached macro or application, highlight the button you want to change and click **Open** to select a different macro or application.

---

## **Using the Dialog Editor**

The dialog editor is used to create a dialog box in a macro for user input. When you create a dialog box, the code for the dialog box is automatically inserted in the macro, as in the following example:



The screenshot shows a Windows application window titled "C:\Aphelion\Macros\jean.apm". The window contains a toolbar with various icons at the top. Below the toolbar is a code editor pane displaying VBA-like code for creating a dialog box. The code includes declarations for variables "a" and "b", definitions for a UserDialog named "Breakbox", and logic for handling user input. At the bottom of the code editor are status bars showing "Line: 1" and "Col: 1".

```
Sub main
    a=10
    Begin Dialog UserDialog ..,180,96,"Untitled"
        OKButton 132,8,40,14
        CancelButton 132,28,40,14
        OptionGroup .OptionGroup1
            OptionButton 20,16,56,8,"Option"
        End Dialog
    Dim Breakbox As UserDialog

    response% = Dialog (Breakbox)

    b=12
```

After you create a dialog box, you can edit it and make any necessary changes. Additional online Help is available in the Macro Dialog Editor Guide.

#### To create a dialog box

1. Right-click in the macro window to display the pop-up menu.
2. Select **Dialog Editor→New** to open the Dialog Editor window.
3. Create the dialog box, adding any necessary buttons, text, check boxes, etc.
4. When you have finished adding components to the dialog box, choose **File→Exit and Return** from the menu bar. The code is automatically inserted in the macro.

#### To edit a dialog box

1. In the macro window, highlight the dialog box code.
2. Right-click to display the pop-up menu.
3. Choose **Dialog Editor→Edit** to open the Dialog Editor window containing the code for the selected dialog box.

---

## Intermediate Symbolic Representation (ISR)

### Intermediate-Level Data

Intermediate Level Data is defined as the representation of an event or set of events in an Image. This representation is more abstract than the pixel values that comprise the Image. For example, events can be lines, regions, points, or chains.

### ObjectSets

An Object is a data structure defined by Aphelion™ to store both the spatial description and attributes of an event. Typically, a method of feature extraction is initially executed using a pixel data Image (low data level) to extract the Objects where different algorithms are used to produce different sets of Objects. A set of Objects from the same original data using the same algorithm is known as an ObjectSet. Various operators are provided that will extract Image events.

### **Displaying ObjectSets**

A segmentation operator automatically displays the resulting set of Objects in the overlay of the image. To display an ObjectSet on a new image, use the AphObjDraw operator.

### **Analyzing and Filtering ObjectSets**

To filter ObjectSets, use the AphObjFilter operator.

See Grid Documents for more information.

### **Object Measurements**

To compute measurements for objects, use the AphObjComputeMeasurements operator.

---

# Printing and Exporting Data

You can format images, charts, and text for output to printers. There are two ways to print from Aphelion:

- Use the Print command to print individual documents that are displayed in Aphelion.
- Use the Print Page Design feature to organize and format the printed layout of images, ObjectsSets, charts, and text.

You can also export data from Aphelion to other applications such as Excel or PowerPoint.

## Print Command

You can print image, chart, text, macro or grid documents from Aphelion. The margins for the printed page are determined by the default margins for the selected printer.

### ***Printing a Document (image, chart, text, macro)***

1. Focus on the window containing the document you want to print.
  - **Image**
  - **Chart** - Charts include histograms, profiles, surface maps, and scatter plots.
  - **Text** - Text is printed using the default font for the selected printer.
  - **Macro** - A macro is printed as text. To change the font, use the Font command on the Macro pop-up menu.
2. From the **File** menu, choose **Print**. The Print dialog box opens.
3. From the Print dialog box, change the Printer options if necessary. For example, you can change the paper size from 8 ½ X 11 to A4.
4. Click **OK**.

### ***Printing a Grid Document (spreadsheet)***

1. Open the grid document.
2. Click the right mouse button to display the Grid pop-up menu.
3. Choose **Export to Excel**.
4. From the **File** menu in Excel, choose **Print**.

## Print Page Design

Use Print Page Design to print a report or other output that includes:

- Images
- Charts - Charts include histograms, profiles, surface maps, and scatter plots.
- Text
- ObjectSets

Within the Aphelion interface, you can arrange the image and chart documents on the page, and create text labels or annotations. You can also use macro functions to produce Print Page Designs.

## ***Creating a Print Page Design***

Before you create a Print Page Design, make sure that the images you want to include are loaded in Aphelion, and that the charts you want to include are open. After you create the Page, you can add text to annotate and label the images and charts.

1. Load the images you want to include.
2. Open the charts that you want to include.
3.  On the Main toolbar, click the Print Page Design button . The Print Page Design window opens. The window represents a page with the size and margins as defined in the default for the selected printer. If you resize the window, the aspect ratio is maintained.
4. Right-click to display the Print Page Design pop-up menu.
  - **Insert an Image** - Display a list of all the images loaded in Aphelion. Click the image you want to insert.
  - **Insert a Chart** - Display a list of all charts open in Aphelion. Click the chart you want to insert.
  - **Insert Text** - Display the Text dialog box. Type the text you want to insert in the Print Page Design and click **OK**.
  - **Print Page** - Send the page to the printer.
  - **Page Setup** - Define the orientation of the page, the margins, and the size of the paper.
  - **Set Unit to Inch** - Set the units to millimeters or inches.

---

**Note:** In the current release of Aphelion, you cannot save the Print Page Design as a file or as part of a project.

---

## ***Arranging Documents in a Print Page Design***

After you insert objects in a Print Page Design, you can arrange the objects on the page or delete them.

---

**Note:** If you modify an image in the Aphelion workspace, the image in the Print Page Design is also modified.

---

1. Focus on the object you want to modify.
2. Click the right mouse button to display the pop-up menu:
  - **Center** - Center the object in the page. You can center it in the horizontal or vertical direction, or in both directions.
  - **Remove** - Remove the selected object.
  - **Resize and Move** - Modify the width and height of the object. You can also use the mouse to change the size.
  - **Change Priority** - Change the priority of the object in the page. Different priorities are: move the object to the front, to the back, and to the middle.
  - **Image Modification** - Display the image by keeping the image ratio.

## **Modifying Text in a Print Page Design**

After you add text to a Print Page Design, you can use the Text Modification option on the Print Page Design pop-up menu to modify the text.

1. Select the text by clicking on it. When the text is selected, a shaded border is displayed around the text.
2. Click the right mouse button to display the Print Page Design pop-up menu.
3. Choose **Text Modification**. The following options are available:
  - **Edit Text**. The Text Edition/Insertion dialog box opens. You can modify the existing text.
  - **Change Color**. The Color dialog box appears. The color you choose affects only the selected text.
  - **Italic**. Italicize the selected text.
  - **Underline**. Underline the selected text.
  - **Change Font**. The Text Font dialog box opens. You can change the height, width, and weight of the font of the selected text.

## **Using Print Page Design Macros**

You can use macro functions to create Print Page Designs. You can insert an object in a Print Page Design that already exists or specify an identifier of a non-existent Print Page Design. In this last case, the function creates the Print Page Design with the specified identifier, and displays it in the main window of the application.

To open a Print Page Design, use AphPrintPage.

To insert an image, a chart, and text, use:

- AphPrintPageInsertImage
- AphPrintPageInsertChart
- AphPrintPageInsertText

The above functions return an objectId that is used in the other macro Print Page Design commands.

To modify the size and the position of objects that are inserted in the page, use:

- AphPrintPageCenterObject
- AphPrintPageDeleteObject
- AphPrintPageMoveObject
- AphPrintPageResizeObject

To print and close the page, use:

- AphPrintPagePrint
- AphPrintPageClose

## **Exporting Data from Aphelion**

When you produce images, charts, and grids in Aphelion, you may want to use these elements in a presentation or report. You can export data from Aphelion into other applications, such

as PowerPoint or MS Word. The following procedures apply primarily to exporting Aphelion data to PowerPoint and Word, and can be modified as needed for other applications.

### ***Using an image in a presentation***

In Aphelion, you can save the following overlays in a .tif file.

- Rectangular ROIs
- Graphic overlay objects, such as rectangles, lines, and freehand drawings.

ObjectSet overlays are not saved with an image. Profile lines and histogram rectangles are also not saved with an image. To create files that include these overlays, see "To use images with an ObjectSet overlay."

#### **To use images in a presentation**

1. Create the images you want to use, by running Aphelion operators, macros, or other operations.
2. Focus on the image you want to export.
3. From the **File** menu, choose **Save As Image**.
4. In the Save As dialog box, type a name for the image file and specify the type of file, such as .tif or .bmp.
  - The default directory for Aphelion images is Aphelion\Images. You can change the directory as needed.
  - The default file type is .tif, but you can also save an image as a bitmap file (.bmp) in some cases. Note: Many Aphelion images cannot be saved as bitmaps because the bitmap format only supports 8 bits.
  - If you save anything other than unsigned 8-bit images, they may not display correctly in other applications.
5. Click **OK**.
6. Open the application in which you are creating the presentation, such as PowerPoint or Word.
7. From the Insert menu, choose Picture. Select the file you want to insert and click OK.

#### **To use images with an ObjectSet overlay**

It is not currently possible to save ObjectSet overlays with an image. If you want to use an image with an ObjectSet overlay in a presentation or report, you can use a paint or screen capture program such as PaintShopPro or SnapShot32 to capture the image in Aphelion and copy it into PowerPoint or Word.

When you copy the bitmap file, you may need to modify or scale the image to get the best results. Refer to the documentation for the program you are using.

1. Create a bitmap file using PaintShopPro or another paint or screen capture program.
2. Insert the bitmap file into your presentation.

### ***Using a chart in a presentation***

In Aphelion, you can create the following kinds of charts:

- Histogram
- Profile

- Surface Map
- Scatter Plot

After you create the chart, you can export it to another application or to a bitmap file.

1. Create the chart you want to use in the presentation. For example, draw a histogram or profile.
2. Focus on the chart you want to export.
3. Click the right mouse button to display the Chart pop-up menu.
4. There are several options for exporting a chart window:
  - **Print.** If you choose Print, you can select which option you want (Best Fit, etc.).
  - **Clipboard.** If you place the file on the Clipboard, you can then paste the file into PowerPoint or Word. This is an efficient method, if you do not want to save the bitmap as a file.
  - **Save As Bitmap.** Save the bitmap file, then import it to a Word document.  
Note: Bitmap files saved using this command can not be exported to PowerPoint.

### ***Using a grid in a presentation***

There are several ways you can use data from an Aphelion grid in another application:

- Export the grid to Excel, then to PowerPoint or Word
- Create an ASCII file

### ***Exporting a Histogram to Excel***

From the Aphelion interface, you can export histogram data directly into an Excel spreadsheet. You can then use the Excel file in a PowerPoint or Word presentation.

1. Select the ImgHistogram operator.
2. Select an input image.
3.  Click the RESULTS button.
4. Choose **Export to Excel**.
5.  Run the operator. The results are displayed in an Excel spreadsheet.

### ***Exporting Grid data to Excel***

From the Aphelion interface, you can export grids directly into an Excel spreadsheet. You can then use the Excel file in a PowerPoint or Word presentation.

1. Generate a grid document in Aphelion.
2. Select the portion of the grid that you want to send to Excel. Select either columns, rows, or a range of cells.
  - To send one or more columns, click once on the title of each column. To deselect a column, click again on the title.
  - To send one or more row, click once on the number of each row. To deselect a row, click again on the number.

- To select a range of cells, use the mouse to drag over the cells you want to export.
- 3. Click the right mouse button to display the Grid pop-up menu.
- 4. Choose **Export to Excel**. The selected columns are automatically displayed in Excel. Note: If Excel was already open, the spreadsheet does not pop-up to the front. Switch to Excel to view the spreadsheet.

### ***Using an Excel Spreadsheet in a Presentation***

1. In Excel, save the file. Adjust the formatting and layout as needed.
2. Open the application in which you are creating the presentation, such as PowerPoint or Word.
3. To insert the spreadsheet file, choose Object from the Insert menu.
  - In PowerPoint, click Create from File in the Insert Objects dialog box.
  - In Word, choose the Create from File tab in the Objects dialog box.
4. Click the Browse button, and locate the file you want to insert.
5. Click **OK**.

---

**Note:** You can copy cells from an Excel spreadsheet and paste them directly into Word as a table. For more information, see the Word on-line documentation.

---

### ***Creating an ASCII file from a Grid document***

1. Create the grid you want to export.
2. In the Operator dialog box, choose the operator **ObjExport** (Object Utilities→Object I/O→ObjExport)
3. As the Input ObjectSet, choose the grid document you want to export.
4. In the Output Filename field, type a file name for the output ASCII .txt file. By default, the file is stored in the C:\Program Files\Aphelion directory. You can click the Browse button (...) to change directories.
5.  Click the Run Operator button to create the ASCII .txt file. You can then export the ASCII file to other applications.

---

## **Product Support**

Please report problems and enhancement requests at the following Web address:

<http://www.aai.com/AAI/APHELION/support>

Username: aphelion

Password: version23

email: aphelion\_support@aai.com

Support is available at the following locations:

**For Europe and Japan, 9:00 am to 5:00 pm (GMT)**

ADCIS SA

Batiment Emergence  
7 rue Alfred Kastler  
14000 Caen, FRANCE  
FAX: 33-2-31-46-26-51

**For the United States and other countries, 9:00 am to 5:00 pm (EDT)**

Amerinex Applied Imaging, Inc  
409 Main Street  
Amherst, Massachusetts USA 01002  
FAX: 413-253-4203

Technical support is handled only by electronic mail or FAX.

## **Amerinex Applied Imaging, Inc.**

Amerinex Applied Imaging, Inc. (AAI) develops and markets software products that employ computer vision technology. AAI's first commercial offering in 1987, the KBVision™ System, was the most innovative and advanced imaging toolset ever introduced commercially. It has been widely used in image understanding research, and has been embedded in third party systems developed by AAI and its OEM customers. AAI's products and technology have established the company as the leading software developer of image understanding tools and solutions.

In recognition of AAI's expertise, the company has received both government and commercial contracts to develop imaging software systems. The Advanced Research Projects Agency awarded AAI a U.S. government contract to develop the IUE (Image Understanding Environment), an advanced system for government sponsored imaging research. AAI was also selected by a major stock exchange to develop stock certificate reading software that uses image understanding rather than template matching to handle free-form documents. Other imaging applications with which AAI has experience include feature-based detection and tracking, and 3D analysis and visualization.

AAI developed the VisionTutor™ System, a computer vision course that teaches basic and advanced concepts of image processing and image understanding. The VisionTutor materials can be used as a college course or as training in a company setting. VisionTutor will be available as an Aphelion™ option on CD-ROM.

In 1995, AAI established a strategic partnership with the French company, ADCIS (Advanced Concepts in Imaging Software), to develop Aphelion software, and to collaborate on other products and projects. The two companies cooperate to market their products worldwide.

The combination of AAI's technology and market focus, its commercial and government relationships, its strategic collaboration with ADCIS, and its professional staff of software engineers and imaging scientists enable AAI to remain a leader in the development of imaging tools and applications.

## **ADCIS SA**

ADCIS stands for Advanced Concepts in Imaging Software. The primary mission of the company is to develop, market and sell imaging products to end-users, OEMs, and VARs that are working in the field of Computer Vision. Currently, the main product of the company is an imaging application called Aphelion™.

ADCIS is located in France, and takes advantage of a privileged location in the high tech area of the "Pole image de Caen", in Normandy. ADCIS relies on a state of the art product, a team

of experts in the field of Image Processing, Image Understanding and Image Analysis, and close relationships to the research centers located in France.

The mission of ADCIS is to:

- Market Aphelion, an Image Processing and Image Understanding software package based on the most innovative imaging algorithms
- Provide turn-key solutions for Image Processing, using Aphelion and specialized hardware such as frame grabbers and other peripherals.
- Deliver high-level support and training on the company's products, as well as consulting on specific vertical vision applications.

ADCIS was founded in July 1995. At its inception, the ADCIS founders signed agreements with the Ecole des Mines de Paris in France and Amerinex Applied Imaging in the U.S. These relationships provide the company with a set of superior algorithms in image processing, image analysis, and image recognition.

ADCIS markets Aphelion in Europe and Japan through a network of specialized distributors.




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